SURGICAL DISEASES

OF THE

KIDNEY AND URETER

INCLUDING

INJURIES, MALFORMATIONS AND MISPLACEMENTS

BY

HENRY MORRIS, M.A., M.B. Lond., F.R.C.S.

FELLOW, AND CHAIRMAN OF THE COURT OF EXAMINERS, OF THE ROYAL COLLEGE OF
SURGEONS; SENIOR SURGEON TO THE MIDDLESEX HOSPITAL; HONORARY
MEMBER OF THE MEDICAL SOCIETY OF THE STATE OF NEW YORK
AUTHOR OF THE HUNTERIAN LECTURES (1898) ON "THE ORIGIN AND PROGRESS OF RENAL
SURGERY," OF "INJURIES AND DISEASES OF THE GENITAL AND URINARY ORGANS"
AND OF "THE ANATOMY OF THE JOINTS," ETC., ETC.; AND EDITOR OF
"A TREATISE OF HUMAN ANATOMY BY VARIOUS AUTHORS"

*WITH TWO COLORED PLATES AND UPWARDS OF
TWO HUNDRED ENGRAVINGS*

In Two Volumes

VOLUME I.

CHICAGO
W. T. KEENER & CO.

1904

PREFACE.

In this work an attempt is made to give a systematic account (1) of the regional anatomy, the malformations and misplacements, and the injuries and surgical diseases of the kidney and of the ureter; (2) of the affections of the perinephric and the peri-ureteral tissue; and (3) of the surgical treatment of these several conditions as recommended and practised at the present time by those most occupied in this branch of surgery.

Though largely based upon my personal experience, the work, without pretending to be of encyclopædic completeness, is also the outcome of long and extensive study of the writings of others.

The *Transactions* of the various societies, and every available journal in the English and European languages which appeared during the decade following the passing for press in November, 1884, of my Manual on the "Surgical Diseases of the Kidney" were carefully searched for articles relating to renal and ureteral surgery, and abstracts were made of all that were found.

Since 1894 the same plan has been pursued so far as was necessary to keep abreast with all that was being accomplished in this branch of surgery; but the labour became increasingly arduous owing to the bewildering rate of production of material, much of which, however, only corroborated settled opinions or previously established facts.

When writing the Manual the difficulty lay in obtaining information owing to the scantiness of material—there was barely an indication of the path to be followed. In writing the present work the difficulty has been of the opposite kind, and has lain in finding time to peruse and opportunities

to fully digest the many articles by the numerous contributors
—the path having been trodden so hard.

Before February, 1880 (the date of the first nephrolithotomy),
besides G. Simon's incomplete work, not more than a score of
articles on renal surgery, chiefly on nephrectomy, had been
written; whereas between 1880 and 1890 Bruce Clarke's Hunterian
Essay (1886), Treatises by Brodeur (1886), Newman (1888), Le
Dentu (1889), and Tuffier (1889), and over three hundred papers
had been published; and between 1890 and 1900 Knowsley
Thornton's Lectures (1890), one volume of Küster's still unfin-
ished work (1894), and about a thousand articles, lectures, and
reports on renal cases and operations appeared.

The development of the surgery of the ureter, which had
barely commenced ten years ago, has of late made remarkable
strides, as is shown by the fact that from 1894 to the present
time about one hundred papers on the subject have been
published, whereas in the five years immediately preceding, the
number might have been counted on the fingers of one hand.

The Manual written in 1883–1884 is the nucleus of Part I.
of this book; but that it is not more than a nucleus may
be inferred from the growth of the literature during the
last decade and a half and from the increase in personal
experience gained by twenty years of practice in renal surgery.
Part II. of this book—namely, that on the ureter—is entirely
new.

The work was commenced in the summer of 1897, and has
absorbed the whole of my spare time since then.

It has been my desire to include everything of value which
has been authentically established regarding the etiology, patho-
genesis, pathology, symptomatology, prognosis and treatment of
the subject matters concerned; and where teaching or practice
differs to give the views of representatives of the various
schools.

If, as is quite certain to be the case, faults, both of omission
and commission are discovered by those who will take the
trouble to read these pages and to study their contents, I would
ask the reader to bear in mind how great a mass of material

has had to be assimilated, and the constant interruptions, so hostile to quiet study and any attempt at literary composition, which must inevitably occur in the daily life of one engaged in active professional work.

If it should seem to any of the numerous writers on the subjects herein dealt with that his own work has not received adequate recognition, I must ask him to pardon the inadvertence and accept my regrets; and this I can do with the consciousness of having honestly endeavoured to bring to my task a spirit of absolute fairness, with the intention of making use of every piece of instruction and every useful suggestion I could glean, wheresoever it was found and with whomsoever it originated.

It has been an object with me to make no statement which is not justified by my personal experience, or supported by the authority of one who has the right to speak from his own experiments, practice, or observations.

It was at first my intention to give a bibliographical list at the end of each subject, but it was found that in many cases each of such lists would run into several pages of print, and I therefore finally decided to simply give the names of the authors referred to or quoted in the work.

A minor feature of the book is an attempt to make the headlines to the pages of real use to the reader, so that by merely turning over the leaves of the volume he can see at a glance mention made of at least one of the leading points described or referred to on each page.

It would have been impossible for me to complete this work without assistance; and I have pleasure in acknowledging my indebtedness to Miss Hannam, to Mr. Arnold Lawson, Dr. W. E. Wynter, and Dr. Campbell Thomson for their services in searching the periodical literature and other sources of information, and in making abstracts and summaries therefrom for my use.

To Drs. Wynter and Campbell Thomson I am further indebted for much assistance in revising and recasting certain of the chapters of my Manual, and to the latter also for

constructing the index and for valuable help in correcting the proof-sheets.

To Mr. Frank Steele I am under a great obligation for the extremely careful manner in which he perused the proofs.

Mr. Clarke of the Royal Medical and Chirurgical Society's Library, and Mr. Hewitt of the Library of the Royal College of Surgeons, have also rendered me service by obtaining and verifying many references.

Nearly all the illustrations are original, and for the most part were drawn specially for this work; this was the case even with those which have appeared already in papers published in the medical periodicals, and in my "Hunterian Lectures." A great many of the drawings were made from specimens removed during life from patients under my care. Several are copies of specimens contained in the Museum of the Royal College of Surgeons or of one or other of the Metropolitan Hospitals, and to the authorities of those Institutions I am indebted for the privilege of being allowed to have drawings made from the preparations.

A few of the figures are reproduced from other works, and are, I hope, in every case properly acknowledged.

I have been very kindly supplied by my friend M. Récamier of Paris with the clichés of two figures illustrating the regional anatomy of the kidney, and by M. Albarran with clichés of his ureteral cystoscope.

To Professor Arthur Robinson I am indebted for the great care and trouble he has taken in verifying and correcting my descriptions of the surgical anatomy of the kidney and ureter; for checking the proof-sheets of these particular chapters, and for some excellent original drawings which appear above his name.

To Mr. Berjeau my thanks are expressed for the skill with which he has made the drawings of recent and museum specimens. The great majority of the figures are from his pencil, and his ability in this class of work is well known to the profession.

Mr. Butterworth I cannot too warmly thank for his admirable

and artistic engravings, and for the patience, care, and interest with which he has executed them.

Finally I desire to acknowledge the great pains taken with the work in the editorial and reading departments of Messrs. Cassell & Co., and to thank the firm for the liberal and courteous manner in which they have met my requests and carried out my wishes.   H. M.

8, *Cavendish Square, W.*
   May, 1901.

CONTENTS OF VOLUME I.

Part I.

SURGICAL DISEASES OF THE KIDNEY.

SURGICAL DISEASES OF THE KIDNEY AND URETER.

PART I.—SURGICAL DISEASES OF THE KIDNEY.

CHAPTER I.

REGIONAL ANATOMY OF THE KIDNEY.

It will be desirable to commence with a description of the normal situation and regional anatomy of the kidney, so as to enable the reader to readily refresh his memory respecting the means whereby it is retained in its position, and the structures which must be cut through or disturbed in the event of any operation upon the organ, or which are likely to be involved by inflammation or suppuration or new growths of the kidney. But first a word or two as to the size and shape of the kidney.

The kidney measures about 4 inches in length, $2\frac{1}{2}$ inches in its transverse axis, and $1\frac{1}{4}$ to $1\frac{1}{2}$ inches in thickness. The left kidney is usually a little longer and a little narrower than the right. The weight of each is from four to six ounces, being somewhat heavier in the male than in the female. **In form** the kidney is compressed from before backwards, so that it presents an anterior and a posterior surface ; a long convex outer border, and a shorter concave inner border with a deep notch, the hilum, at its mid-point ; and an upper and a lower extremity, each of which is somewhat wider than the transverse measurement of the central part of the organ, the upper extremity being usually somewhat wider than the lower.

The anterior surface is convex and looks somewhat out-wards away from the sides of the bodies of the vertebræ, as well as forwards. **The posterior surface** is flattened and is directed somewhat inwards towards the tips of the spines of the vertebræ, as

well as backwards.   Its upper two-thirds or thereabouts are under
cover of the eleventh and twelfth ribs, but its lower one-third descends
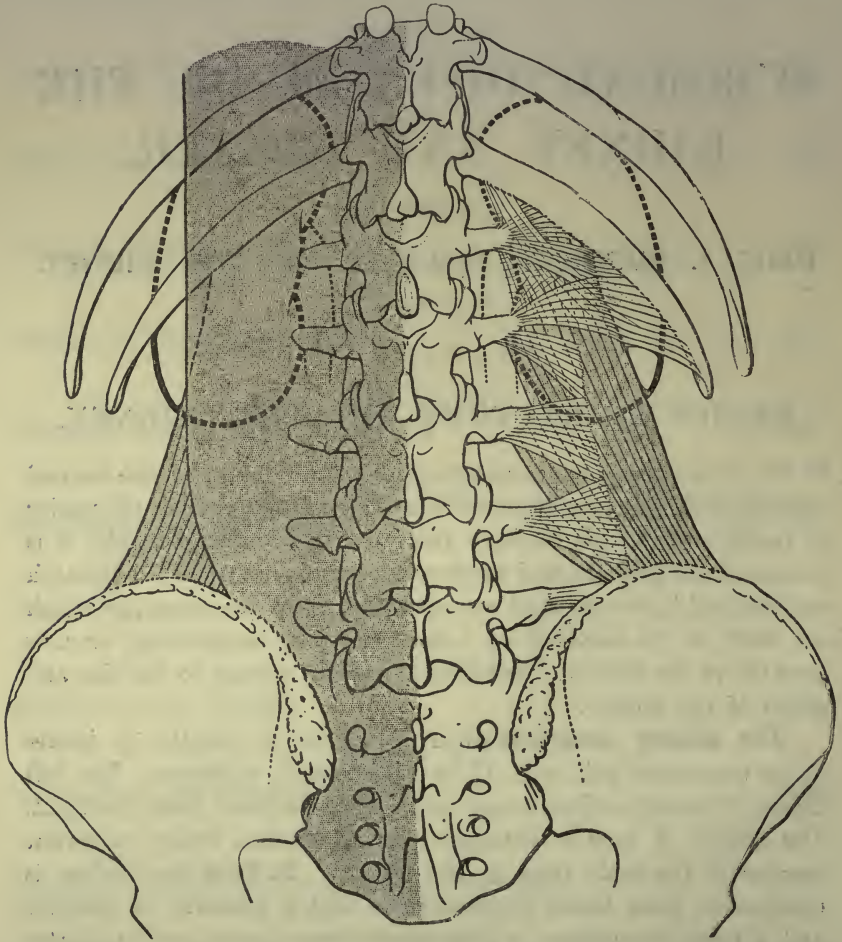
Fig. 1.—The Lumbo-costal or Vertebro-costal Ligament, attached to the transverse
    processes of the first and second lumbar vertebræ, and to the twelfth rib,
    which is long. (*After Farabeuf and Récamier.*)

below them. Occasionally the twelfth rib is too short to extend across
this surface of the kidney. Henle and Récamier describe a fibrous
ligament (*vertebro-costal*), which reaches from the tips of the transverse
processes of the first and second lumbar vertebræ upwards and
outwards, to be attached to the twelfth rib, or to the eleventh rib

when the twelfth is abnormally short. This ligament is a process of the anterior layer of the transversalis aponeurosis. The inferior extremity of the kidney descends but a short distance below it (Fig. 1). The thick rounded **upper end** of the kidney is about one centimetre nearer the spinal column than the **lower end,** and has a slightly more posterior position : the suprarenal capsule descends a little upon its anterior aspect.

Borders.—Owing to the oblique direction of the surfaces and extremities of the kidney the outer convex border is inclined somewhat upwards and backwards towards the parietes of the loin, whilst the inner border looks somewhat downwards and forwards. The outer border at its upper part is $3\frac{1}{4}$ inches from the middle line of the body, and at its lower part it is $3\frac{3}{4}$ inches from this same line. The hilum of the left kidney is 2 inches from the aorta, and the hilum of the right kidney about 1 inch and $\frac{3}{4}$ from the vena cava ; these are important facts to bear in mind in performing nephrectomy.

The position of the kidneys is deep in the loins along the sides of the last dorsal and first three lumbar vertebræ. The kidney rests about equally upon the diaphragm and the anterior layer of the posterior aponeurosis of the transversalis muscle, which separates it from the quadratus lumborum muscle ; to a slight extent internally and inferiorly it rests also upon the psoas muscle. The upper edge of the kidney corresponds with the space between the eleventh and twelfth ribs, and the lower edge is nearly on a level with the middle of the third lumbar spine. The right kidney as a whole is lower than the left, but occasionally the left, owing to its more elongated shape, extends downwards lower than the right.

The kidney is enveloped in a bed of areolo-fatty tissue. This tissue is called the **tunica adiposa,** or fatty capsule. It is scarcely marked in the infant or before the tenth year. It is thick and abundant posteriorly as well as at the hilum and upon the convex border ; but in front, between it and the anterior layer of the perinephric fascia, it is very thin. It is a little thicker again above and behind ; and below the inferior end of the kidney it is very thick, and forms quite a cushion which is continuous below with the cellulo-fatty tissue of the false pelvis.

This perinephric fatty tissue has a very striking appearance and contrasts markedly with ordinary fat, being very soft and fine in texture and of a delicate canary-yellow colour. It is traversed by

very fine and loose cellular tissue fibres, which pass from the
proper fibrous capsule of the kidney to the perinephric fascia, and
which are rather stronger and better marked at the extremities
of the organ.   It is itself but loosely connected with the proper
fibrous capsule of the gland ; but sometimes, after inflammatory
changes have taken place in it, the adhesion between them is
very intimate and even inseparable.

It is perhaps to this " packing " of areolar fatty tissue, more
than to any other single feature of its anatomy, that the kidney
owes its fixity of position in the recess of the loin.   But in spite
of this, and of the restraint afforded by the perinephric fascia,
the vertebro-costal ligament and the peritoneum which covers
its anterior surface, the kidney has, in certain persons, an
undoubted tendency to shift from its bed and become displaced.

The amount of fat in the tunica adiposa is variable.   In fat
persons it is often very considerable, and may mislead one at
the bed-side examination as to the size of the kidney itself.
Again, when fat persons lose flesh rapidly the fatty elements of
the tunica adiposa are quickly absorbed, the capsule becomes loose,
and its connections both with the kidney and the surrounding
perinephric fascia are relaxed.

The perinephric fascia—The kidney, covered by its proper
fibrous capsule, to be again mentioned later on, and embedded
in its adipose capsule which has just been described, is contained
within a sheath of thin fascia, which has of late been specially
studied by Anderson, Zuckerkandl, Gerota, Glantenay* and
Gosset, and others.   This perinephric fascia consists of two layers,
an anterior and a posterior, which meet above and on the
outer side, but not on the inner side or below.   To this fascia
is attached a very important *rôle* in the fixation of the organ
(Plate I., Figs. 2 and 3).

The anterior layer is thinner than the posterior, and
follows the course of the peritoneum which covers it.   It passes
over the anterior surface of the kidney and suprarenal capsule,
and the structures at the hilum, and is continuous across the
middle line with the corresponding layer of the perinephric
sheath of the opposite kidney.   On the left side it is, according to

* Glantenay and Gosset, " Le Fascia Péri-rénal," *Annales des Maladies
des Organes Génito-urinaires*, 1898, p. 118 *et seq.*

PLATE I.

Fig. 1.—Vertical Section of Kidney through the Pelvis and Calyces (the anterior half seen from behind). 1 and 1′, the Capsule and Cortex ; 2, the Pyramids of Malpighi ; 2′, Papillæ of Pyramids in section ; 3, the Columns of Bertini ; 4, the interior of the Pelvis ; 5, the Calyces ; 6, the Papillæ anterior to the line of section ; 7, Section of a Calyx with the entering Papilla ; 8, the Renal Artery ; 8′, posterior branch of the Renal Artery ; 9, the Renal Vein ; 10, the Ureter. (*After L. Testut.*)

Fig. 2.—Vertical Anterior-posterior Section through the Kidney (diagrammatic). 1, Diaphragm ; 2, Retro-renal Fascia ; 3, Perinephric Fat ; 4, Paranephric Fat ; 5, Pre-renal Fascia. (*After Glantenay and A. Gosset.*)

Fig. 3.—Horizontal Section through the Kidneys (diagrammatic). 1, Peritoneum ; 2, Pre-renal Fascia ; 3, Retro-renal Fascia. (*After Glantenay and A. Gosset.*)

PLATE I.
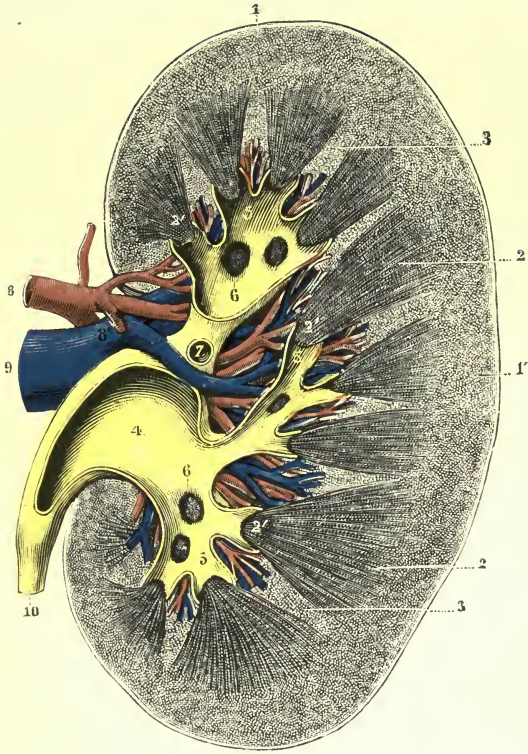
Fig. 1.
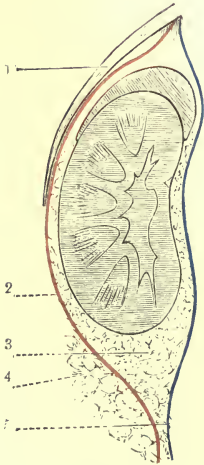
Fig 2.
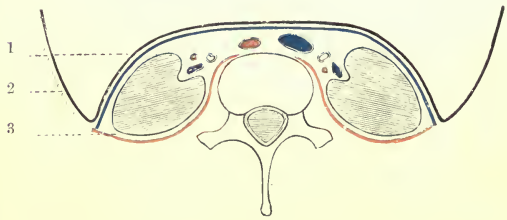
Fig. 3.

Zuckerkandl, rather thicker than on the right.   Above, it joins with
the posterior layer of the fascia, and becomes firmly attached to the
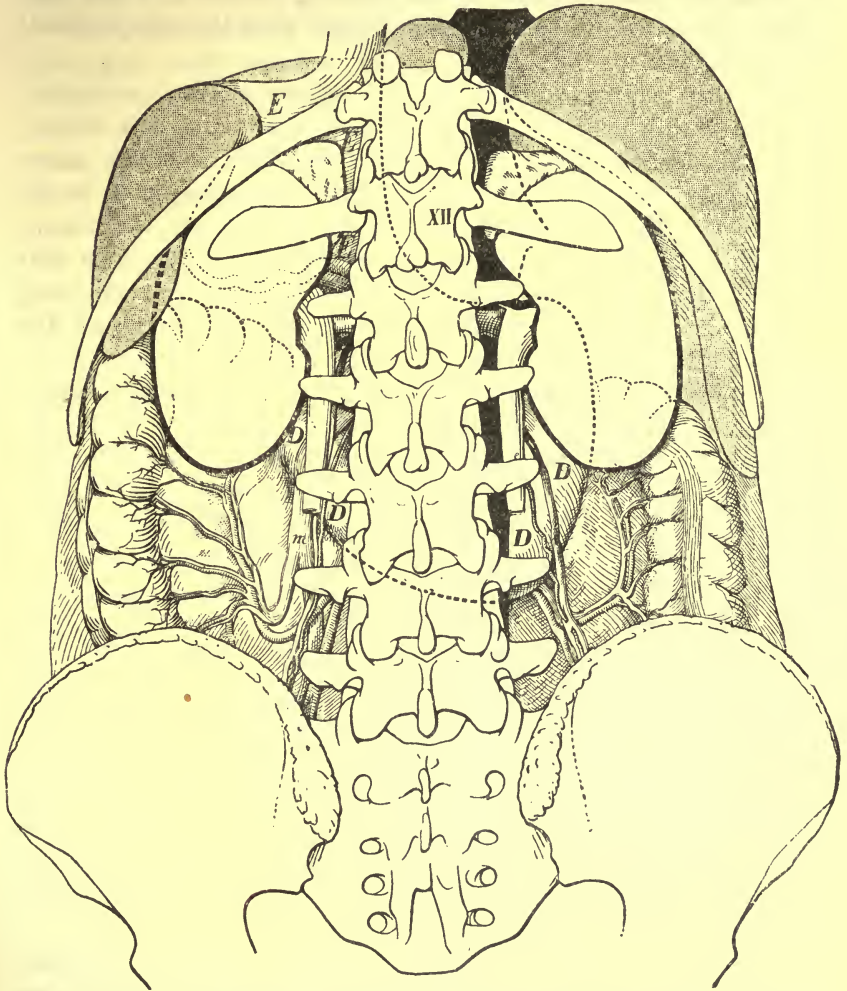
Fig. 2.—Showing the relations of the Kidney to the Liver, Spleen, Colon, Stomach (E),
and Duodenum (D).   XII., Twelfth Dorsal Vertebra; *m*, Left Colic Branch of
Inferior Mesenteric Artery.   (*After Farabeuf and Récamier.*)

diaphragm (Fig. 21, p. 103); below the kidney it becomes gradually
thinner, and is finally continued into the cellular tissue of the iliac fossa.

The posterior layer is attached along the median line to the
bodies of the vertebræ and the inter-vertebral discs; it passes over

the psoas and over the aponeurosis in front of the quadratus lumborum, and having reached the external border of the kidney it joins the anterior layer at the point of reflection of the peritoneum, and is continued indistinguishably with the sub-peritoneal fascia (Fig. 22, p. 104).

By this arrangement of the two layers of the perinephric fascia a sheath or investment is formed—containing the kidney, its cellulo-fatty capsule and its adrenal—which is closed above and along the outer border, but is open along the inner border and below. This explains why the movements of the kidney occur in an inward and downward direction, and how it is that inflammations of the cellular tissue of the pelvis can ascend along the ureter by continuity to the cellulo-fatty tissue around the kidney and at the hilum.

The peritoneum adherent to the front surface of the kidney is reflected off its convex border on to the abdominal wall. To a certain degree the kidney can be moved under the peritoneum covering it, but in addition to that the peritoneum moves with the kidney. The kidney can also move within its fatty capsule, as well as with that capsule within the perinephric fascia.

Relations to other organs.—The front of the *right* kidney is in contact above with the posterior part of the under surface of the right lobe of the liver; at the middle towards the left side with the second part of the duodenum, and lower and to the right with the hepatic flexure of the colon; and below, in the angle of the hepatic flexure, with a coil of small intestine. Where it is in contact with the liver and the small intestine it is covered with peritoneum, but where it is in relation with the duodenum and hepatic flexure it is devoid of peritoneum, and it is in direct contact with the bare posterior surface of the wall of the gut (Fig. 2).

The upper part of the front of the *left* kidney is separated from the fundus of the stomach by the splenic artery, and then comes in contact with the pancreas; lower down along its left side it is in relation with the commencement of the descending colon, and internal to the colon, with a coil of small intestine. The external border of this kidney is in contact in the upper two-thirds of its extent with the spleen and in the lower third with the descending colon (Fig. 2). At its upper and lower

ends and along the upper part of its left border, it is covered by peritoneum; the remaining parts are in direct contact with the adjacent viscera without the intervention of peritoneum.

The connection of the suprarenal capsules with the kidneys diminishes with age, and in the adult is not usually very firm, owing to the interposition of a layer of cellulo-fatty tissue, which does not exist in the foetus at full term. The right adrenal rests upon the upper pole of the right kidney, and the left adrenal is in relation principally with the upper part of the inner border, and only slightly with the upper pole of the left kidney. The connection is rather more intimate on the left side, because the left suprarenal vein generally joins the renal vein, whereas the right goes direct to the vena cava. The suprarenal capsule is contained within the layers of the perinephric fascia, which do not unite as described by Sappey at the level of the upper pole of the kidney but pass, one in front of and the other behind the adrenal, and only when above it become fixed together and contract firm adhesions with the under surface of the diaphragm.

Surface anatomy.—The kidney occupies a space which is represented on **the anterior surface** of the body in Fig. 3. A horizontal line through the umbilicus is below the lower edge of each kidney; a vertical line carried upwards to the costal arch from the middle of Poupart's ligaments has one-third of the kidney to its outer side, and two-thirds to its inner side, *i.e.* between this line and the median line of the body.

On the posterior surface of the body its boundaries are indicated by the following : (1) A line parallel with and one inch from the spine between the lower edge of the tip of the spinous process of the eleventh dorsal vertebra and the lower edge of the spinous process of the third lumbar vertebra.

(2) A line from the top of this first line outwards at right angles to it for $2\frac{3}{4}$ inches.

(3) A line from the lower end of the first transversely outwards for $2\frac{3}{4}$ inches.

(4) A line parallel to the first and connecting the outer extremities of the (2) and (3) lines just described (*see* Fig. 4).

The structures which cover the posterior aspect of the kidney within this space are the following, enumerated in their order from without inwards :—

(1) After reflecting the skin, the superficial fascia is exposed, and ramifying in it are the external branches of the posterior primary division of the eleventh and twelfth dorsal, and first, second, and third lumbar nerves; the posterior branches of the lateral cutaneous offsets of the tenth and eleventh dorsal nerves; and some small cutaneous branches from the intercostal and lumbar arteries which ramify with the corresponding nerves.

Beneath these is the deep fascia.

(2) After removing the deep fascia, the aponeurosis and some of the lower posterior fleshy fibres of the latissimus dorsi muscle appear.

(3) Beneath the latissimus are (a) the serratus posticus inferior, the fibres of which take an outward, forward, and upward direction from the spines of the vertebræ to the lower ribs; (b) the posterior layer of the aponeurosis of the transversalis muscle, which, together with the aponeurosis of origin of the latissimus dorsi and serratus posticus inferior, constitute the fascia lumborum; (c) to the outer edge of the fascia lumborum, which itself corresponds to the outer edge of the erector spinæ muscle, are the fleshy origins of the internal, and the posterior free edge and the fleshy origin from the twelfth rib of the external oblique muscles of the abdomen; (d) all the twelfth rib except its head and, when long, its anterior extremity (Fig. 1), the external intercostal muscle between it and the eleventh rib, and about two inches of the eleventh rib near its angle, and also a triangular area of the tenth intercostal muscle.

(4) The erector spinæ muscle: beneath and to the outside of

Fig. 3.—Relative Position of the Kidneys to the front surface of the Abdomen.

this muscle the middle layer of the posterior aponeurosis of the transversalis abdominis, and externally to this again the undivided aponeurosis, and the fleshy fibres of the transversalis muscle. Piercing the aponeurosis of this muscle at its outer part is the anterior primary branch of the last dorsal nerve, its ac-companying vessels, and the ilio-hypogastric nerve. The first lumbar artery gives off a branch which pierces the deep fascia and runs along the outer border of the erector spinæ in the groove between that muscle and the quadratus lumborum. This branch is often of considerable size.

(5) After removing the erector spinæ muscle and the middle layer of the transversalis aponeurosis and some of the fleshy fibres of the transversalis, we see the trunks of the last dorsal nerve and its accompanying vessels, and the abdominal branches of the second, third, and fourth lumbar arteries and veins, the levator costæ of the twelfth rib, the tips of the trans-verse processes of the three upper lumbar vertebræ, the

Fig. 4.—Relative Position of the Kidneys to the posterior surface of the Body.

posterior surface of the quadratus lumborum on which the lumbar arteries rest, and the inter-transverse muscles. The first and the last lumbar arteries pass in front of the quadratus, but the second, third, and fourth pass behind that muscle. The edge of the quadratus extends beyond the outer edge of the erector spinæ below and is well seen without disturbing the sacro-lumbalis or ilio-costalis muscle, but above it is usually hidden beneath the erector (Fig. 5).

(6) In front of the quadratus lumborum is the anterior layer of the posterior aponeurosis of the transversalis muscle, the last

dorsal, ilio-hypogastric, and ilio-inguinal nerves and the outer
part of the psoas muscle; and in front of these again is the
paranephric adipose tissue, the perinephric fascia, and the tunica
adiposa of the kidney.

(7) On removing or opening up the tunica adiposa, the whole
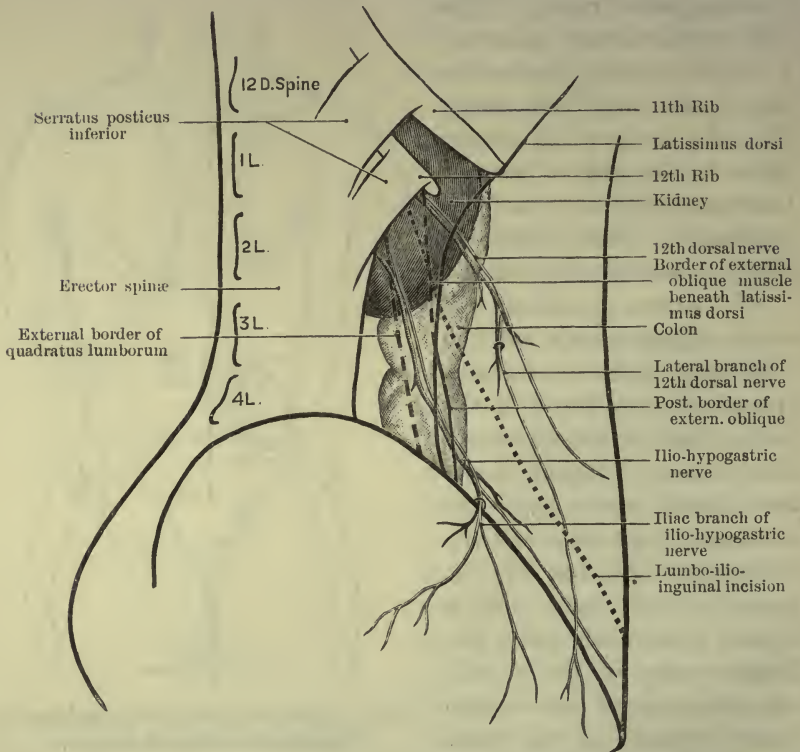
Fig. 5 —Showing the relation of Structures behind the Kidney and in the Ilio-costal
space.   (*From a dissection by Professor Arthur Robinson.*)

of the posterior surface of the kidney, the pelvis of the kidney,
and the commencement of the ureter are exposed.   For this
purpose, however, it is necessary to drag the lower ribs upwards
with the tips of the fingers; but the removal of the ribs is not
requisite unless the ilio-costal interval is unusually contracted.
It is common to find arterial twigs from the renal artery piercing
the capsules of the kidney, and ramifying in the adipose tissue,

where they anastomose with branches of parietal vessels.   Some
of the perinephric branches from the renal artery equal in size a
lumbar artery.

Posterior to as well as above the upper part of the kidney
is the diaphragm with its origins from the ligamentum arcuatum
externum and from the eleventh and twelfth ribs.   Between the
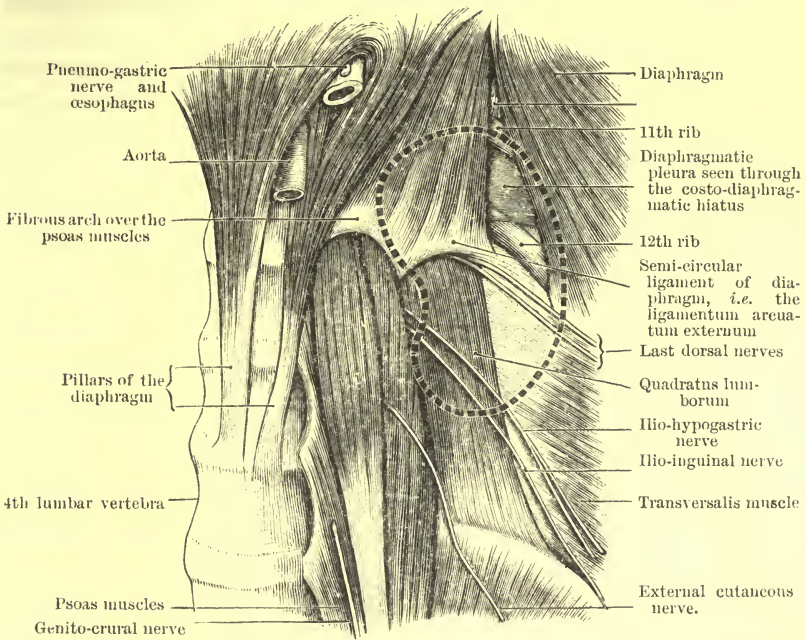
Fig. 6.—Anterior view, showing Costo-diaphragmatic Opening.   (*After Testut*).

origin from the ligament and those from the eleventh and
twelfth ribs is the costo-diaphragmatic hiatus bridged, across by
a little cellular tissue and the pleura (*see* Fig. 6).   The pleura
lining the eleventh and twelfth ribs and overlying the neigh-
bouring part of the diaphragm, and, in deep inspiration, the
wedge-shaped edge of the lung, intervene between the surface
of the body and the back of the left kidney at its upper end.

Below the right kidney, and below and to the outer side
of the left kidney, is the colon, in connection with which the
arteries and veins from and to the superior and inferior

mesenteric trunks can be traced (Fig. 2). The right kidney is in contact with the under surface of the liver, upon which it makes a slight depression; and the left kidney touches the spleen, the splenic artery, and the pancreas, as described above.

The fibrous tunic of the kidney is a thin, smooth, but firm and closely fitting envelope. Numerous fine elastic fibres enter into its construction and give it considerable power of stretching and contracting, according to the degree of vascular tension of the organ.

This thin capsule adheres by minute processes of connective tissue and capillary vessels to the substance of the kidney, from off which, in a healthy organ, it can, however, readily be stripped. Beneath the capsule there is an imperfect layer of plain muscular fibres.

The capsule, following the hilum or fissure in the renal substance, passes into the sinus of the kidney so as to become continuous around the bases of the papillæ of the pyramids with the strong external fibrous muscular and elastic tissues of the calyces and pelvis of the kidney.

If the ureter is traced upwards it is found to lose its cylindrical form on a level with the lower end of the kidney, where it begins to expand into a large funnel-shaped dilatation known as the *pelvis* or *infundibulum*. After entering the hilum the pelvis divides within the sinus of the kidney into two or sometimes even several primary tubular branches (Fig. 7), which, in turn, end in several short truncated but rather wide pouches, named *calyces*, the mouths of which receive the papillæ. The calyces are connected with the bases of the papillæ in the following manner. The external fibrous tunic of each calyx is continuous, as just stated, with the fibrous tunic of the kidney; the circular fibres of the muscular or middle tunic of
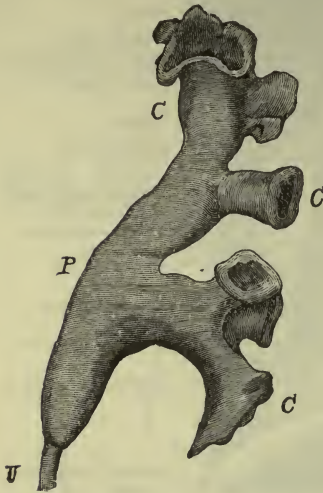

Fig. 7.—Cast of the Interior of the Infundibulum and upper end of the Ureter. (Henle.)

u, Ureter; p, pelvis or infundibulum; c, calyces.

the ureter are continued over the renal pelvis and terminate where the calyces are attached to the papillæ, forming the annular muscles of the papillæ (Henle).   The longitudinal muscular fibres can be traced for a short distance into the substance of the kidney; lastly, the internal or mucous coat of the calyx, or at least its epithelium, is reflected over the papillæ to become continuous with the lining of the uriniferous tubes of the pyramid which opens on the surfaces of the papillæ.   A single calyx often surrounds two or it may be three papillæ, so that the calyces are less numerous than the pyramids of the kidney.   The sinus of the kidney is occupied also by the main branches of the renal vessels, and by a quantity of fat; this fat fills up the space between the calyces, and serves as a soft and elastic bedding for them and for the vessels of the kidney.

The relation of the structures at the hilum of the kidney, *i.e.* **of the structures which form the pedicle of the kidney.**— Besides the dilated upper end (renal pelvis) of the ureter, the renal artery and vein, a quantity of connective tissue, and a large number of lymphatics and nerves enter into the formation of the pedicle.

The *renal artery* is of large size; large out of all proportion to the size of the organ it supplies.   It arises from the side of the aorta a little below the superior mesenteric artery, the right taking origin generally a little lower down than the left.   Owing to the position of the aorta on the left of the middle line, the artery of the right kidney is longer than the left and crosses behind the inferior vena cava.   Before reaching the hilum of the kidney each artery divides into three chief branches, which sink into the sinus behind the corresponding branches of the renal vein, two usually being in front and one behind the pelvis of the ureter.   Deeply in the sinus of the kidney these branches break up into a number of smaller vessels which leave the sinus between the calyces to enter the substance of the kidney between the papillæ (*see* Plate I., Fig. 1).   Before entering at the hilum the artery gives off one or two small branches to the suprarenal body and to the ureter, and several twigs to the fatty and connective tissue around the kidney.   Some branches of the renal artery pierce the capsule of the kidney to supply the circumrenal tissue.

The *renal vein* is a short wide vessel which, like the artery,

takes an almost horizontal course. Its primary branches, four
or five in number, issue from the hilum in front of the branches
of the artery, and then the vein continues in front of the renal
artery till it joins the vena cava. The vein from the right
kidney is usually a little lower down than that from the left,
but the left vein is longer than the right, and usually crosses
in front of the aorta, below the superior mesenteric artery and
above the third part of the duodenum, to reach the vena cava.
The left renal vein is joined by the left spermatic vein ; both
right and left renal veins receive tributaries from the suprarenal
capsule of their own side.

The *lymphatics* of the kidney are very numerous. The
superficial set form a plexus in the fibrous capsule. The deep
ones issue from the sinus with the blood-vessels, and both sets
end in the lumbar glands.

The *nerves* consist of filaments from both the sympathetic and
cerebro-spinal systems. They accompany the renal arteries and are
derived from the renal plexus and the lesser splanchnic nerve.

The *connective tissue* forms a packing for the other structures
in the renal pedicle. Peritoneum covers the front surface of
the pedicle, and sometimes, when the kidney is " floating,"
more or less surrounds it.

The ureter.—The manner in which the ureter is connected
with the kidney, and the relations of this tube at the hilum,
have just been described. We will here only briefly consider
the course of the ureter, and its anatomical connection with
the bladder, referring the reader for a fuller account to the
section on the anatomy of the ureter (Vol. II., p. 277).

The renal pelvis, formed by the union of the calyces, is directed
downwards and inwards from the hilum, and after becoming
gradually contracted assumes a cylindrical form opposite the lower
end of the kidney. Thence it is called the ureter proper (*see* Fig. 7).

The ureter measures about 12 inches (30 cm.) in length
in the adult, and is about the size of a goose-quill. The lumen
of the tube is by no means uniform.

As the ureter passes downwards and inwards to the brim
of the pelvis it lies immediately behind the peritoneum, and
has but a very loose connection, by means of cellular tissue,
with the parts on which it rests. These parts are the psoas

PLATE II.

Figure showing the relation of the lower end of the Ureter to the Vesicula
   Seminalis. The kidney, vessels, bladder, and rectum, with peritoneum
   covering them, have been removed *en masse* and figured from their
   posterior aspect. A, Abdominal Aorta ; V, Inferior Vena Cava.

PLATE II.

Ureter

Ureter

Cæcum

Peritoneum

Peritoneum

Rectum cut

Vas deferens

Bladder

Ureter

Right Vesicula
Seminalis

Prostate

Rectum cut
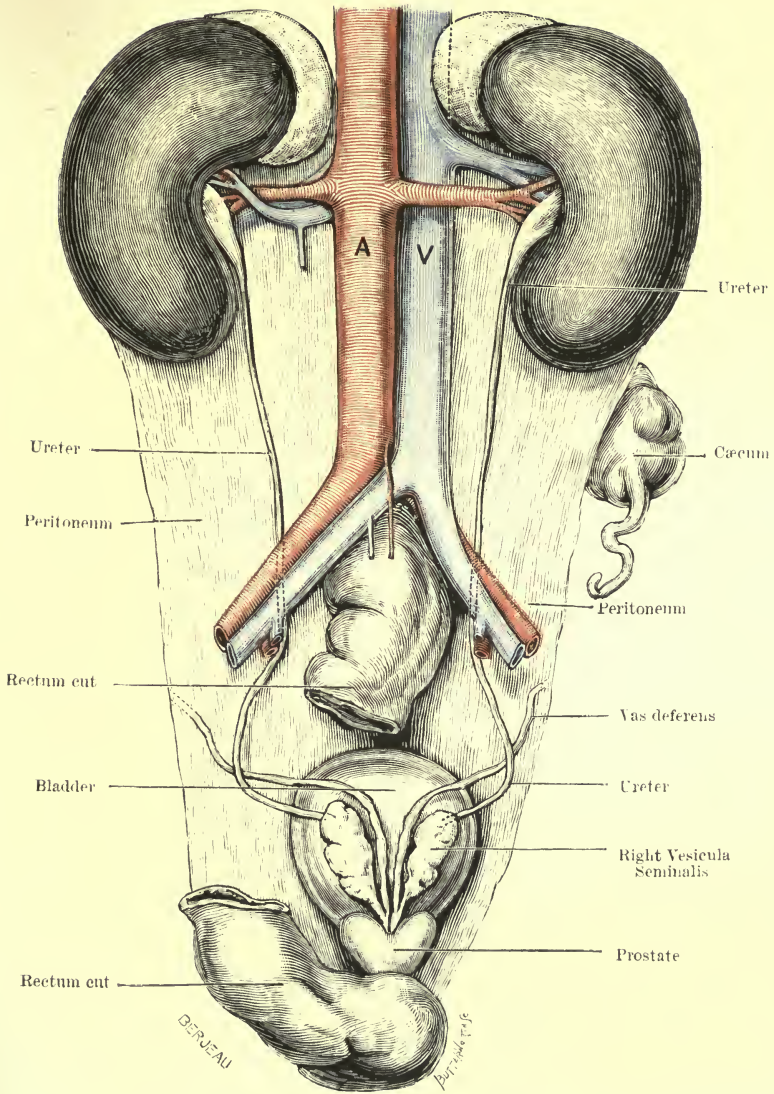
muscle and genito-crural nerve in the abdomen, the common or external iliac artery as it crosses the pelvic brim, and in the pelvis the internal iliac artery. In the abdominal part of its course the ureter is crossed on both sides by the spermatic or ovarian vessels, and, in addition, on the right by the third part of the duodenum and the right colic and ileo-colic arteries, and on the left by the left colic and sigmoid arteries, and at the pelvic brim it is crossed by the termination of the ileum on the right and by the first part of the rectum on the left. The right ureter is close to the outer border of the inferior vena cava. Having entered the pelvic cavity it lies at first on the lateral wall running downwards and backwards on the obturator fascia, and crossing the obliterated hypogastric artery and the obturator vessels and nerve on their inner sides; in this part of its course it is covered internally by peritoneum, which separates the left from the rectum and the right from the terminal part of the ileum. After reaching the level of the spine of the ischium it turns abruptly inwards on the surface of the levator ani to the base of the bladder, and its relations differ considerably in the male and female. In the *male* it is crossed in front by the vas deferens, which passes backwards and downwards between it and the side of the bladder; it touches the posterior part of the side of the bladder and enters the base, $1\frac{3}{4}$ inches (4·3 cm.) from its fellow of the opposite side and in front of the apex of the seminal vesicle (Plate II.). In the *female* it is surrounded by numerous veins derived from the uterine and vaginal plexuses; it passes from one-third to half an inch (8–13 mm.) above and to the outer side of the lateral fornix of the vagina, crossing beneath the broad ligament and uterine artery at the side of the neck of the uterus, from which it is separated by loose connective tissue. The distance between the cervix uteri and the ureter is from three-quarters of an inch to one inch (1·8 to 2·5 cm.). The ureter terminates in the base of the bladder. It is $1\frac{3}{4}$ inches (4·3 cm.) from its fellow of the opposite side, and in front of the anterior vaginal wall a quarter to half an inch (6–12 mm.) below the anterior fornix.

The ureter traverses the wall of the bladder obliquely for a distance of three-quarters of an inch, and opens on the inner

surface of that viscus by a narrow slit-like orifice, one inch distant from the orifice of the opposite ureter, and about the same distance behind the urethra.

After the ureters have pierced the outer and middle muscular strata of the bladder, the fibres of their own muscular coat are disposed, according to Ellis, as follows : the internal, the most numerous, are directed transversely, and unite with the corresponding fibres of the opposite ureter ; whilst the remainder join the submucous muscular layer of the bladder, and are directed obliquely downwards over the " triangular space " to the submucous strata of the urethra.

Sir Charles Bell pointed out that on dissecting off the inner coat of the bladder two strong fleshy bands (**the muscles of the ureters**) are seen to descend from the orifices of the ureters towards the urethral opening. Just behind the prostate these bands are well marked and fleshy, and after uniting with one another become tendinous, and are inserted into the lower and back part of the middle lobe of the prostate.

As the ureters lie in the vesical wall they are much nearer to the inner than the outer surface of the bladder, the muscular coat being posterior to them.

Irregularities of the renal arteries.—These are so common that some deviation from the regular condition is to be expected in three cases out of every seven. The variations have reference to the number, origin, branching, points of entrance into the kidney, and, lastly, to the distribution of branches to parts around.

It is much more common for the arteries to be increased than decreased in number, and the greatest number is usually found on the left side. Both renals have been seen arising by a common stem from the front of the aorta (Portal).

Multiple arteries may be derived from the aorta, suprarenal, lumbar or internal, external or common iliacs ; from the middle sacral, the right hepatic, or the colica dextra.

According to Macalister additional arteries arise from the various sources in the following order of frequency :—

> Suprarenal (very common);
> 2nd or 3rd lumbar ;
> Right hepatic ;

> Colica dextra ;
> External iliac ;
> Internal and common iliac ; and
> Middle sacral (very rare).

A unique case has been recorded by Otto in which a branch from the right common iliac supplied the left kidney.

Renal arteries may enter the kidney on either surface, **or** at either extremity ; but usually all the vessels pass in at the hilum.

From the renal artery branches are given off almost constantly to the suprarenal capsule ; occasionally also to the diaphragm or its pillars ; to the colon, pancreas, or right lobe of the liver. A branch to the testis may supplant the normal spermatic artery.

The renal veins are likewise liable to various abnormalities as to their numbers and distribution.

The above variations occur *unassociated* as well as associated with malformations and misplacements of the kidney.

CHAPTER II.

ABNORMALITIES OF THE KIDNEY.

THE abnormalities of the kidney fall into three groups:

> 1. THE ABNORMALITIES OF POSITION.
> 2. THE ABNORMALITIES OF FORM, and
> 3. THE ABNORMALITIES OF NUMBER.

This last group is sub-divided into:

A. *Single or unsymmetrical kidney, where one is entirely absent.*

B. *Solitary or fused kidney, where the two kidneys are massed together.*

C. *Imperfect development, or atrophy of one kidney.*

D. *Absence of both kidneys.*

E. *Supernumerary kidneys.*

1.—THE ABNORMALITIES OF POSITION. MISPLACEMENTS OF THE KIDNEY.

The study of misplacements of the kidney is important to the clinical physician and practical surgeon who desire to escape errors in diagnosis and catastrophes in operating. Such misplacements give rise to abdominal tumours, sometimes difficult to diagnose. It is therefore necessary to remember that the kidney is not always situated within the normal limits of its anatomy. It is not very unfrequent for one or both kidneys to be somewhat misplaced, either as regards their distance from the spine or their relation to the diaphragm above, or iliac crest below. Misplaced kidneys are very often somewhat misshapen. The kidney may be movable as well as misplaced. M. Rayer, who was the first to give a satisfactory account of this subject, divided misplacements of the kidney into two groups: namely, those in which the misplacement is permanent, or, in other words, in which the kidney is fixed in an abnormal position; and those

in which the misplacement is not permanent, that is, where the kidney is movable as well as misplaced. Subsequent writers have grouped these cases under three headings, namely, " simple misplacement," " movable kidney," and " floating kidney." In the simple misplacements the kidney may be higher or lower, nearer to or farther from the spine than usual, or may have its axes and borders altered in any direction, or may be turned over upon its anterior surface, but yet thoroughly fixed in its position, whatever that position may be. A kidney is " movable " when, though appreciably mobile to a greater or less extent, it is situated entirely behind the peritoneum. It is " floating " when the peritoneal investment allows the kidney to float or drop forwards, or to be moved in an upward or downward, or indeed in any direction.

Simple misplacements may be either congenital or acquired. (a) *Congenital.* — Amongst the permanent misplacements of the kidneys the most frequent is the horse-shoe kidney ; after the horse-shoe variety the most common misplacement is into a position over the sacro-iliac synchondrosis or the promontory of the sacrum, or just below the bifurcation of the aorta, or in the false pelvis just above Poupart's ligament. In such cases it is common for the renal artery, or one of the renal arteries when there are more than one to the same kidney, to be derived from the aorta close to its bifurcation, or from the common iliac artery of its own, or even of the opposite side. The suprarenal capsule is occasionally, though by no means always, misplaced along with the kidney. It was so in nine out of twenty-four cases observed by Newman, who remarks : " Malposition of the kidney does not necessarily involve an alteration in the position of the suprarenal capsule " (*Medical Press and Circular,* May 3rd, 1899).

Cruveilhier states (" Descriptive Anatomy ") that " when the kidneys are situated higher than usual, the suprarenal capsules are placed on their inner side, and correspond with the renal fissure ; when the kidneys occupy the pelvic region, the capsules do not undergo the slightest change in their position, and no longer have any connection with them."

Slight misplacements of the kidney are comparatively common (in 1,000 post-mortem examinations Newman found twenty-four cases

in which the position of one or both kidneys might be described as abnormal), but usually have no clinical significance whatever, and unless special attention is directed to them these slight alterations in position may easily be overlooked in post-mortem examinations. The more pronounced misplacements—as when the kidney occupies the iliac fossa or rests on the promontory of the sacrum, between the rectum and bladder, or by the side of the uterus—are much rarer, and when they occur may give rise to grave symptoms and complications, and have led to fatal disasters in practice.

In women, such malpositions have given rise to serious obstruction during parturition; and to great suffering at the menstrual periods, owing to the contact of the misplaced kidney with the ovary (Polk's case).

It is more frequent for one kidney to be misplaced than for both. Newman has reported a case in which the right kidney was misplaced to a position a little to the right of the promontory of the sacrum, and the left into the left iliac fossa. The left kidney is much more commonly at fault than the right. Förster (Virchow's *Archiv*, 1858, xiii., 275) mentions a case in which the left kidney was misplaced into the right loin, yet its ureter, after descending behind the colon, entered the bladder on the left side: it was not a case of the ureter of a right kidney opening into the left side of the bladder. Durham recorded four cases of simple misplacement which had come under his own knowledge, two at Guy's Hospital, and two in private practice. These were all congenital; in three the left kidney was involved, and in one the right. In each, the kidney lay over the corresponding sacro-iliac synchondrosis, and extended more or less into the true pelvis in front of the sacrum or its promontory. In two of them the kidney was misshapen as well as misplaced. The sex of the two Guy's cases is not given. The other two cases were both men. Durham remarked, "Thus within two years four cases of misplacement of the kidney have fallen under my observation. Such abnormalities, therefore, cannot be extremely rare. At the same time, it must be stated that on searching through the records of more than 1,600 post-mortem examinations, made at Guy's during the last few years, I have only been able to find the two cases quoted above." To this statement I may add, that during the twenty-four years

ending 1897, in the post-mortem records of the Middlesex Hospital, containing 6,536 examinations, there were but four instances of misplaced kidneys. One was in a lad, aged nineteen years, who died of chronic Bright's disease, and the left kidney was situated upon the common iliac vessels. The second was in a man, aged fifty-seven; here the right kidney was on the brim of the true pelvis, lying upon the external iliac vessels, with its lower end applied against the right side of the bladder: in this case there was a double ureter. The third instance was that of a boy, aged sixteen, in whom the right kidney was found to be firmly fixed, but rotated in such a way that its upper end was much nearer the spine than usual. The fourth occurred in a female, aged forty, and was exhibited by Dr. Voelcker (*Trans. Path. Soc. Lond.*, 1896, p. 173). In this case the right kidney was situated in the right iliac fossa, and the right renal artery arose from the right common iliac artery. The right suprarenal body was in its normal position. The uterus was unicornis, there being no trace of the right half of this organ.

During the ten years ending 1882, the Guy's Hospital post-mortem records contain the accounts of 4,632 examinations, and amongst them there are seven instances of misplaced kidneys. The analysis of these seven cases is as follows: Three were in men, three in women, and one in a child aged eight months, who had both kidneys misplaced into the pelvis. Two were left kidneys, one in a man, one in a woman; three were right kidneys, two in women, one in a man. In the child both kidneys were separate; in one case (a man) the two kidneys were united, and rested on the promontory of the sacrum; the union was not horse-shoe-shaped. In two instances the misplacement was acquired; once owing to enlargement of the liver and tight lacing, the right kidney was displaced downwards, and turned completely over; and once owing to the drag of a large renal cyst in a woman, whose liver was enlarged and contained a withered hydatid cyst. In one case the right kidney was malformed and misplaced on to the psoas muscle at the brim of the pelvis, and was lying on its back. In another case (man, aged forty-five) the right kidney was below the brim of the pelvis; and another (man, aged twenty-six) the left kidney was lying chiefly below the

brim of the pelvis, in the depression between the psoas and the vertebræ, and it could be pushed so far upwards that half of it came to be above the pelvis. Putting these several figures together, there are seen to be 12,768 post-mortem examinations yielding thirteen instances of misplaced kidney. We may, therefore, expect on the average to find at least one out of every thousand bodies containing a misplaced kidney.

A case in which both kidneys were displaced on to the brim of the pelvis has been recorded by Potherat (Soc. Anatomique, February, 1889). The right kidney was in a large measure destroyed by cystic degeneration without any naked-eye alteration of its ureter, while the left kidney was considerably augmented in volume, apparently due to a compensatory hypertrophy. The suprarenals occupied their normal situations. This anomaly was also associated with a displacement of the duodenum, which was situated in front of the inlet of the pelvis.

Sometimes the misplaced organ is abnormal in size, or form, or in respect to its ureter or blood-vessels. In one case in which the left kidney was in front of the fifth lumbar and first sacral vertebræ, its long axis was almost vertical, but the usual position of the organ was reversed, so that its convex border looked towards the right and its hilum towards the left (Farquharson).*

Some deviation of the large intestine from its normal position has been often found associated with the misplacement of the kidney, more especially of the left kidney. When the left kidney occupies the iliac fossa, or is situated over the left sacro-iliac synchondrosis, there is generally no sigmoid flexure in the left iliac fossa; but the descending colon passes across the middle line, and the rectum commences on the right side of the sacrum. Malformations of the genital organs, such as undescended testicles, rudimentary vas deferens, double uterus and vagina, are also frequently associated with this condition. The peculiarities in the origin and connections of the blood-vessels and ureters, the malpositions of the large intestine, and the malformations which are found associated with misplaced kidney, suggest, if they do not prove, the congenital nature of the misplacement. In structure the misplaced organ is, as a rule, quite normal.

*Journ. Anat. and Phys., April, 1894, p. 303.

(*b*) *Acquired.*—Simple misplacements result from pathological enlargements of neighbouring organs, such as the liver, spleen, pancreas, and suprarenal bodies; and from the pressure of tumours. Laennec saw a right kidney which had been jammed down opposite the iliac crest by the liver. Tight lacing is sometimes the cause of downward displacement of the kidney. The right is more frequently affected than the left, because the liver is less able to resist the compression than the organs in the left hypochondrium. In this way the head of the right kidney gets sometimes dislocated from its position between the liver and diaphragm, and the whole organ becomes turned, so that its long axis is in the antero-posterior direction, with the upper end projecting forwards between the liver and the colon. Such a kidney may be movable, and it is said sometimes to have compressed the colon or vena cava. Wilks and Moxon have seen the kidney in this position, but there were no ill effects in their cases.

In one of the Guy's cases (No. 417, 1874) above referred to (p. 21), the liver was large, contained two masses of cavernous tissue, and was much pushed down by tight lacing. The right kidney was displaced downwards and inwards towards the median line, was turned completely over, and was lying on the psoas muscle and the spinal column, with its anterior surface posteriorly, and the ureter running downwards and inwards in front of the kidney. Its position was oblique from above downwards and outwards; its upper end, being behind the duodenum, pushed that part of the gut well forwards from the spine; the lower end came to the surface between coils of the small intestine; the colon was below the kidney. The kidney was not easily moved upwards or downwards, but was easily replaced in its natural position as regards its surfaces, and could also be brought into a line with the long axis of the body. (This is case iv. in the Report of the Committee of the Pathological Society, vol. xxvii. of the *Transactions,* p. 472.)

The kidney may be displaced in an upward, or downward, or lateral direction; or it may be rotated upon itself so that the hilum looks upwards, outwards, directly forwards or backwards. Ruysch has figured a right kidney with its hilum above and its convex border below, and its ureter passing behind the

kidney. It occurred in a woman, aged forty, who died of heart disease with pleuritic and peritoneal effusions. A good example of acquired misplacement is amongst those in the Guy's Hospital case books (No. 247, 1879). A woman, aged fifty-seven, who died of phthisis, had in her liver a cured hydatid, the size of a Tangierine orange. The left kidney was displaced on to the brim of the pelvis by a large cyst in its lowest part, which contained a pint of yellow fluid. The fluid had a urinous odour, and there were echinococci in it. The cyst had dragged the kidney down; and the cyst itself occupied the greater part of the pelvic cavity. The glandular substance of this kidney and all the rest of the urinary organs were normal, except that the other kidney (the right) only weighed three ounces. An instance of misplacement upwards of the right kidney above the level of the last rib, probably the consequence of perinephritis in very early life, will be described in the section on malformed kidneys.

The acquired, like the congenital misplacements of the kidney, have been mistaken for abdominal tumours.* They have also been known to obstruct or otherwise complicate labour; but, as a rule, the malpositions which are unattended by mobility of the kidney are only discovered on post-mortem examination, and give rise to no symptoms during life. A calculus, even of considerable size, may be impacted in the ureter of a misplaced kidney, and give rise to no symptoms whatever. Such a case is recorded by Mr. Canton.† A man, aged twenty-seven, died of bronchitis; there had been no renal symptoms; the right kidney was quite normal, but the left was situated below the bifurcation of the aorta, and between the common iliac arteries; it was lobulated and of a rudely oval shape, with its pelvis directed forwards, and dilated, owing to the impaction of an oxalate of lime calculus, which weighed two and a half drachms, in the upper part of the ureter (Fig. 8).

In Bindley's case, quoted by the Committee of the Pathological Society of London, a uric acid calculus, weighing a hundred grains, was found in the pelvis of a misplaced and very "movable" right kidney; but there is no mention made of any renal

* See pp. 27–29.
† Path. Soc. Trans., vol. xiii., p. 147.

symptoms during life referable to the misplacement, mobility,
or calculus.

When occupying a position within the true pelvis the misplaced
kidney may be discovered accidentally by vaginal or rectal ex-
amination. In this event it has to be distinguished from a
morbid growth or an inflammatory swelling ; and the diagnosis
will rest chiefly on the size and growth and elastic character of
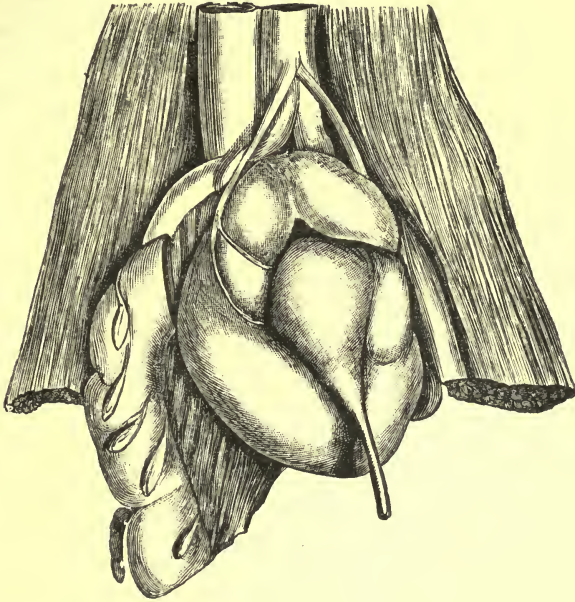
Fig. 8.—Representing lobulated appearance of the Kidney, and its relations
to the Aorta and Sigmoid Flexure of the Colon.

Misplaced and malformed left kidney.   Misplaced sigmoid flexure of colon.   (Canton, *Path. Trans.*)

the misplaced body, and in the want of the usual fulness
and resistance in one or the other loin. If the swelling has
a reniform outline, the diagnosis will be facilitated. But, as
frequently happens in congenital misplacements, and also in the
acquired cases when the misplacement is due to an alteration
in the organ itself, the kidney has not the usual form, so that
the want of the characteristic outline must not unduly influence
the diagnosis.

If the degree of suffering caused by the misplaced kidney necessitates surgical treatment, nephrectomy will in most cases be the only available resource, unless it be possible to fix the kidney in a position in which it will cease to cause pain. A case has been recorded by Owen (*Med. Press and Circ.*, May 10, 1899), in which nephrectomy was performed for a misplaced kidney which gave rise to constant abdominal pain. The kidney could be felt by rectal examination as a tumour lying in the concavity of the sacrum, but its nature could not be definitely diagnosed. Laparotomy proved it to be a well-shaped left kidney, which was successfully enucleated from its bed behind the rectum, and removed. It is, however, quite exceptional for simple misplacement of the kidney to need any treatment at all.

2.—THE ABNORMALITIES OF FORM. MALFORMATIONS OF THE KIDNEY.

By "malformations" of the kidney is here meant congenital deviations from the natural form and size of that organ.

The kidney becomes changed in outline and dimensions by various diseases. Thus, hydro-nephrosis, pyo-nephrosis, cystic enlargements, morbid growths such as sarcoma and cancer of the kidney, tubercle, and the scarred, contracted, and atrophied condition which results from Bright's disease and interstitial nephritis, are all so many forms of "misshapen" kidney. These are described under their several headings. Here we are concerned only with congenital malformations of the kidney.

Formerly such malformations were only physiologically interesting; now, owing to the fact that operations upon the kidney are daily being performed, they are clinically of importance. They are important from this point of view (1) because malformed kidneys are frequently the result of fusion of both kidneys, so that there is but one renal mass in the body; (2) because malformed kidneys, even when only one kidney is involved, are generally misplaced; and (3) because when a misplaced kidney is also misshapen, the difficulty in diagnosing the nature of the abdominal tumour which may be formed is greatly increased, and the probability of injurious treatment being adopted is much enhanced. The following case recorded by

Durham in the *Guy's Hospital Reports* * of 1860 shows the importance of bearing in mind the last statement.

A gentleman, aged forty-five, after suffering from a severe attack of fever, noticed for the first time a tumour deeply seated in the hypogastric region, and somewhat to the left of the middle line. This tumour was oval in form, somewhat elastic to the touch, and fixed. It was not nodulated, nor did it possess any distinctive elevations and depressions. Manipulation gave rise to very disagreeable sensations, but not to acute pain. Considerable alarm was felt by the patient, especially as some members of his family had died from " tumour in the abdomen." More than one skilled opinion was taken by the patient, and the conclusion arrived at was that a " tumour of doubtful character " existed in the lower part of the abdomen, for which iodine ointment was to be applied, and iodine of potassium taken internally. This treatment was continued for some time, but of course without effect ; the patient never thoroughly recovered his health and strength, and between four and five years after first noticing the tumour he died of pulmonary disease. At a post-mortem examination the tumour was seen to be nothing more than the left kidney misplaced and malformed. The right kidney was normal in form and position. Both kidneys were healthy in structure and of usual weight. The left kidney had no hilum, and did not possess the characteristic shape. When divested of fat it presented two depressions, one of which extended obliquely across the anterior surface, and the other was on the inner and posterior aspects ; thus it was indistinctly divided into three portions. The ureter resulted from the junction of four branches ; of these, two came from the upper and posterior part, while the two principal ones came from the anterior and lower part ; these branches joined one another about an inch from their several points of exit from the kidney.

There were three arteries, one from the aorta, just above its bifurcation, one from the common iliac artery of the *opposite* side, and one from the internal iliac of the same side. These branches entered different parts of the kidney ; the chief supply was derived directly from the aorta. There was one principal vein, which passed from the internal and posterior part of the

* Third series, vol. vi., p. 407.

organ into the vena cava, just above the junction of the two
common iliac veins.   The suprarenal capsule was large, flat, and
in its normal position.   The kidney was situated over the left
sacro-iliac synchondrosis, and extended somewhat on to the pro-
montory of the sacrum, and by its lower part into the true pelvis.

In this instance the kidney was first discovered as a "tumour"
after the patient had become emaciated by the fever ; and, owing
to its abnormal shape, no suspicion of its being a misplaced
kidney seems to have arisen ; but, as Durham remarks,
"had a correct diagnosis been made, how much alarm and
anxiety the patient and his friends might have been spared, and
how much irritating and useless treatment might have been
avoided ! "

Diagnosis.—But the question, "How is error to be avoided,
and a correct diagnosis to be made ? " remains to be considered.
It must be allowed that this is no easy matter, because the
abnormality of form deprives us of a characteristic aid to
diagnosis which fortunately exists in most cases of movable
kidney.   There is no hilum, perhaps ; and if there be, it will
almost certainly lack the normal relation to the rounded extremi-
ties and the concave and convex borders of the kidney, for neither
the rounded extremities nor the natural oblong outline of the
kidney may be present.   The smooth, firm, but elastic surface
of the swelling gives but little information ; for a lobulated or
deeply grooved kidney may feel quite smooth and uniform when
covered by a thick layer of circumrenal fat, as in Durham's case
and others.   The misshapen organ may be movable and capable
of being pushed back into the loin ; but it is far more likely to
be fixed as well as misplaced.   If the kidney is displaced a tympanitic
note may be elicited by percussing over the ilio-costal interspace
behind, and there may be the loss of the usual resistance in the
loin.   Neither of these conditions, however, can be depended upon,
because the region naturally occupied by the kidney is sometimes
filled up by a quantity of condensed fatty tissue when the kidney
is misplaced.   Nor is there anything constant in the characters
of the malformation which can be used as a guide.   As will be
shown directly, there is great variety in the change of shape.
There are, however, two signs which should assist the surgeon
to a right judgment ; these are (1) the peculiar disagreeable,

sickly, faint sensation, without acute pain, which is sometimes caused by manipulation of the kidney; and (2) the fact that if an abdominal or pelvic tumour is formed by a malformed kidney the tumour is one which does not progressively increase in size. The peculiar sensation, provoked by pressing upon or otherwise manipulating the kidney, is as characteristic in its way as the testicular pain which is caused by manipulating or pressing the testicle. It is a combination of sickening, fainting, and aching sensations; not actual pain, though it may be accompanied by pain along the thigh or over the hypogastrium.

Close and repeated examination of the urine, especially after manipulation of the swelling, or during constipation of the bowels, may show occasional alterations in quantity or composition, or in both; and there may be periods of painful or frequent micturition brought on by muscular efforts, by manipulation of the tumour, or by pressure upon it by hardened and retained fæces. These are the only diagnostic signs, so far as I am able to gather, of a tumour caused by a malformed kidney.

Form.—The varieties of malformations of the kidney are very numerous, but may be classified as follow :—

1. Variations in size.

2. Malformation of one or both kidneys without any junction or fusion of the organs.

3. Fusion of the two kidneys either in the form of a " horseshoe " kidney or some other irregular-shaped mass.

1. *Variations in size.*—The commonest of these variations is the so-called congenital atrophy, in which one of the kidneys is very small, and this is of importance to the surgeon, since there is always the fear, though fortunately a remote one, that such may be the condition of the remaining kidney after nephrectomy has been performed on the opposite side.

I have endeavoured to estimate what this risk is by the examination of a vast number of post-mortem records, and I find that the condition occurs in rather less than one in every five thousand cases (*see* p. 39). In these cases the atrophied kidney consists of a mass of connective tissue, quite useless for secreting purposes, or it may be represented by a cyst.

2. *Malformations of a kidney without fusion.*—The second class of malformed kidneys is that in which the two organs are not

in any way joined or fused with each other, but one or both of them are malformed. The malformed organ may occupy its natural position, or may be misplaced. Fig. 9 shows an hour-glass constriction of a kidney. An interesting case of malformed and misplaced kidney has been described by Mr. Canton and figured (Fig. 8, p. 25).

In this class the commonest variety is lobulation of the organ. Sometimes the lobulation is as marked as in the fœtal kidney. In one case of which I have notes,* this was the condition of both the kidneys of an old woman, aged seventy. In another case from the same records (vol. 1881, No. 106), both the kidneys of a man, aged thirty-one, besides being lobulated, were also much flattened, owing probably to the fact that the renal arteries came off from the aorta between two aneurysms, so that doubtless the renal blood supply had been much disturbed. This was a combination of congenital and acquired abnormality of form. In a third case (1881 vol., No. 211) both kidneys of a woman,

Fig. 9.—Hour-glass Constriction of Kidney. (Guy's Hospital Museum, No. 1585.)

aged fifty-five, were much lobulated, and a deep transverse fissure divided the anterior surface of the left. In these cases, and in others of marked congenital lobulation of which I have the notes, the kidneys were in their natural position. In a fourth case (vol. 1879, No. 110) the left kidney was misplaced and malformed, having a trilobate shape, with three arteries derived from different parts of the aorta. Its hilum was in front, and its ureter came off from its anterior surface. Its posterior surface was marked by a sulcus, in which the common iliac artery rested. This kidney was situated upon the left common iliac vessels. The

* *Middlesex Hospital Register*, vol. 1874, No. 5; Surgical.

patient was a lad, aged nineteen, who died of chronic Bright's disease. In another instance (vol. 1879, No. 77), in a woman who died of carcinoma of the right side of the chest, the right kidney was granular and contracted and " curiously deformed." It was very small, and almost completely divided into two equal parts by a deep constriction. The left kidney was twice the size of the right. In another (vol. 1874, No. 1) both kidneys of a woman, aged forty-five, were found malformed, the right being quadrate in shape, and the left prismatic; they were in their proper situations, and their structure was healthy.

In a case the notes of which I obtained from the manuscript records of Guy's Hospital * (vol. 1880, No. 402), both kidneys of a woman, aged

Fig. 10.—Two Malformed Kidneys joined by a transverse band of fibrous tissue. Diagrammatic (*Guy's Hospital MS. Records.*)

thirty-five (who died of suppurative perimetritis and endo-carditis), were found malformed, and the right one was misplaced as well (Fig. 10). The *right* kidney lay upon the psoas muscle at the brim of the pelvis, and as it were upon its back, its shape being " altered and difficult to recognise." The hilum was on the anterior surface, and out of the hilum passed the pelvis, the ureter taking an oblique direction across the kidney from above downwards and outwards. The *left* kidney was in its proper position, but lying like the right, as it were upon its back, with its pelvis emerging from the anterior aspect, and its ureter passing across the anterior surface. The hilum of each kidney formed part of a deep fissure, which cut the organ almost into two, so that the appearance suggested to some was that
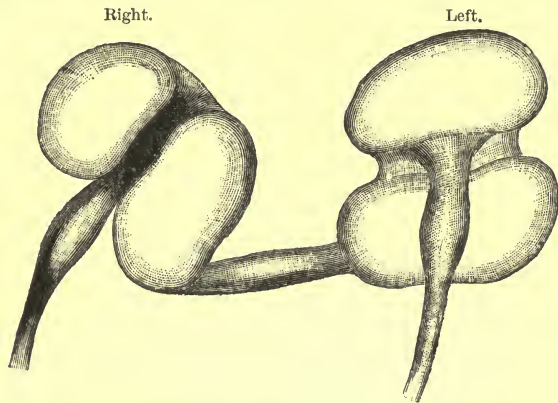
* Not the *Guy's Hospital Reports*, to which a distinguished author on renal surgery who copied the illustration from my earlier book refers it. The case has never been published elsewhere.

there were four kidneys.   Each organ had, however, but a
single pelvis and ureter.   Another remarkable condition about
these oddly shaped kidneys was a tough white tendinous band
running from one to the other at their lower part (Fig. 10).   This
band was part and parcel of the capsules of the two kidneys,
and represented the isthmus which lies across the spine in the
common form of horse-shoe kidney.   The right kidney had two
arteries derived from the aorta and entering the fissure on the
front surface of the organ.   The left kidney had three arteries,
two of which entered the under surface of the lower part of
the organ, the other ran with the vein to the hilum on the
front.   One of the two vessels to the lower part came from the
common iliac artery.

Lastly, in some cases, deformity of the kidneys seems to have
depended upon the structures immediately in contact with the
organ, especially when the latter is misplaced.   I have mentioned
above one case in which the posterior surface of a kidney was
deeply grooved by the common iliac artery.   M. Aubé reported
a case of left kidney misplaced between the common iliac arteries,
and flattened, having its anterior surface divided into three parts
by two depressions formed by the passage of two arteries.   Other
similar cases might be quoted

3. *Fusion of the kidneys.*—In the third class of malformations
the two kidneys are fused together.

The best-known variety of this class is the so-called horse-shoe
kidney, but there are several other ways in which the two organs
may be united into one mass, such as the sigmoid and the discoidal.
Fusion of the two kidneys is always accompanied by some dis-
placement, and the mass is generally situated at a lower level
in the abdomen, and nearer the middle line, than usual.   The
malformations due to fusion belong more properly to the next
section, and are therefore described under " abnormalities in
number."

As a guide to the relative frequency of the various misplace-
ments and malformations, the following analysis of ten years'
post-mortem examination at two London hospitals is appended.

At Guy's Hospital, out of the total number of cases during the
ten years ending 1882, namely, 4,632, there were fourteen instances
of misplaced or malformed kidneys.   Of these fourteen cases :

7 were misplaced, including two slightly movable.

1 was very movable.

5 were horse-shoe shaped.

3 were malformed. Of these three, one was a fused and misplaced renal mass; in another, both kidneys were malformed and the right one was misplaced as well; the third was simply malformed, being elongated in shape and having two ureters. The details of two of these cases have been given above; those of the case of fusion will be given farther on.

At the Middlesex Hospital, out of the total number—namely, 2,610—of post-mortem examinations, there were nineteen cases of malformation. Of these nineteen cases :

9 were lobulated; in four cases both kidneys, in five only one organ being thus affected.

6 were congenitally atrophied as to one kidney.

1 was horse-shoe shaped.

4 were malformed, but not fused.

4 were atrophied from disease.

In one case the same kidney (right) was congenitally lobulated and atrophied. In another both kidneys were lobulated, and the left one had a *deep transverse fissure across its front surface.* In a third the left kidney was lobulated, *misplaced,* and *trilobate.* In a fourth case an atrophied kidney was almost *divided into two parts.* In a fifth case one kidney was *quadrate* and the other *prismatic.*

There was no record of movable kidney and none of double pelvis or ureter in the reports for this period of the Middlesex Hospital. A double renal pelvis is, however, so common that it is now probably rarely deemed worthy of record.

It will be noticed in the above analysis of the Middlesex Hospital cases that there were six cases of congenital atrophy of one kidney. This is not to be read as six cases of absolute congenital deficiency of one kidney. On the contrary, there was not one such case amongst them. The smallest of them seems to have weighed one and a half ounces. Of the four cases of atrophy from disease, in one the kidney substance was " entirely atrophied," and in another " the kidney was so small and atrophied that scarcely any renal tissue was left and there was no obstruction in the ureter."

Since the above statistics were compiled a further analysis of 3,926 cases has been made from the post-mortem records of the Middlesex Hospital, 1884–1897, with the following results :— There were five cases of congenital atrophy of one kidney ; in one of these the left kidney was only represented by a small mass of tissue, and another is described as lobulated and undeveloped and in a fœtal condition. In addition to these there were two cases of atrophy from impervious ureters. There were ten horse-shoe kidneys. There were three cases of misplaced kidneys ; in one case the kidney was situated on the brim of the pelvis with its lower end touching the bladder, in another the right kidney was firmly fixed and rotated, so that its upper end lay considerably nearer the spine than usual, and in the third case the organ was situated in the pelvis.

There were two cases of floating kidney, and in one of these both kidneys were affected. In the case in which one kidney was affected it was the right organ, and the kidney could be made to describe a segment of a circle, the radius of which was 5 inches, its centre being near the lower margin of the left hepatic lobe. In the second case both kidneys are described as being unduly movable, and the right could be moved down below the brim of the pelvis and across to the left of the middle line, but there is no special description of its mesenteric attachment.

There were sixteen cases of double ureters, and in two of these the lower duct opened into the urethra. In one case there was a double ureter on each side.

In the Guy's Hospital analysis, as given above, the total number of cases in which the kidney was either " atrophied," " wasted," or " shrunken " was forty-seven. Not one of these, however, was an instance of complete non-development or congenital deficiency ; but all cases of small kidneys from Bright's disease and interstitial nephritis are included.

I have collected fifty-four cases of various malformations which were published in the several American and English journals during the ten years 1883–1893 : an analysis of which shows the following relative frequency of the different kinds of abnormalities usually met with :—

11 were cases of congenital absence of one kidney.
8 congenital atrophy or ill-development of one kidney.
1 congenital atrophy or ill-development of both kidneys.
8 horse-shoe kidney.
9 misplacements of one kidney.
2 congenital polycystic kidney.
2 malformation of the ureter.
2 congenital hydro-nephrosis (1 double, 1 due to pressure of the ureter by a branch of the renal artery).
5 double ureter (in 2 cases the doubling was on both sides).
2 absence of ureter (in 1 case the kidney was a collection of small cysts).
2 solitary conjoined kidney.
1 atresia of vesical orifice of ureter.
1 atrophy following obliteration of ureter of non-congenital nature.

3.—The Abnormalities of Number.

To the surgeon of the present day the absence of a kidney is a subject of vast importance, and one which must be duly taken into account when nephrectomy is contemplated. Though there are certain conditions in which it is less improbable than usual that only one kidney exists (as, for example, when some congenital deformity or abnormality, more particularly of the genital organs, is present), there are, on the other hand, cases in which the surgeon may be sure that his patient is possessed of both kidneys. In some instances of hydro-nephrosis and in some calculous cases the complete plugging of one ureter is known to have occurred by the alteration in the symptoms during the course of the disease, and yet in despite of the occlusion urine continues to be excreted. The urine voided naturally in such case must come from a second kidney. So, too, must it in cases of renal fistula with a free draining away of urine from the fistula and an equally, or more, abundant excretion through the urethra. Still there are cases in which less definite evidence is obtainable, and then it is important to know the average probability of only one kidney being present. I shall endeavour now to answer this question.

But first let us inquire what is understood by single kidney. Morgagni* divided these cases into two classes, namely, those in which one renal mass is made up of two kidneys, and those in which one kidney only has been formed. These latter he subdivided into those in which the single kidney occupies the

* Letter xlviii., art. 16.

loin as usual, and those in which it is misplaced on to the spine
or into some central position. In Morgagni's day (1769) several
cases of each class had been collected, and they have been since
made use of by later writers, especially by Rayer. The term
"solitary kidney" had frequently been used as a general name
for all cases in which there was only one renal organ; but
Rokitansky limited this name "solitary kidney" to the renal
mass which consists of the fusion of the two kidneys; and he
employed the name "unsymmetrical kidney" in cases in which
one kidney only is present, and its fellow altogether deficient.
Rokitansky's definition of an "unsymmetrical kidney" was, a
kidney which "is normal in position and conformation, and
occasionally rather enlarged, its fellow being deficient." Exception
must, however, be taken to this definition, because the existing
kidney may be abnormal either in conformation or position.
In a case * in which the absence of one kidney led to a disastrous
result after nephrectomy, the only existing kidney occupied the
left iliac region.

     There is a real distinction between the two classes described
by Morgagni and Rokitansky, and named by the latter "solitary"
and "unsymmetrical." But a third class of single kidney must
be added to these two, namely, those in which the second organ
is "atrophied," for in not a few individuals one kidney is so
little developed or so completely destroyed that there is practically
but one kidney present. To the surgeon who is contemplating
nephrectomy there is no practical difference between congenital
absence, extreme congenital atrophy, or rudimentary develop-
ment of one kidney, and total destruction of one by disease.
There are, then, at least three varieties of single kidney, two
of them being forms of deficiency of one kidney, and the third
a fusion of the two kidneys into one mass.

     A. Unsymmetrical kidney, *i.e.* entire absence of one kidney.

     B. Solitary kidney, *i.e.* fusion of the two kidneys into one
mass. This class includes the horse-shoe kidney.

     C. Atrophy; including congenital rudimentary kidney, or
congenital atrophy.

     It would seem that quite a host of examples of con-
genital absence of one kidney in man as well as in the lower

          * *New York Med. Journ.*, Feb. 17, 1883; Dr. W. Polk.

animals have been met with ; and the first impression made
by the numbers of recorded cases is that single kidney must be
quite a common event. Morgagni refers to many. Rayer col-
lected about fifty cases, Mosler twelve, Roberts refers to five others,
and I have the notes of four cases dissected by Bland-Sutton.
If, however, the cases referred to by Rayer are carefully inves-
tigated we find that few of them are satisfactorily reported ;
and if we bear in mind that Rayer's investigations extended
over a great part of the literature of a century and included
the results of researches which went back to very early times ;
that most of the cases quoted by him had been enumerated
by Morgagni and other previous writers, and did not come
immediately under his own observation ; and, lastly, that we
have no record as to the proportion which these cases bore
to the total number of subjects examined, it is obvious that
we cannot draw any conclusion whatever from them as to the
frequency of the congenital absence of one kidney.

Some years ago I made a careful examination of the descriptions
of forty-six cases of single kidney derived from sources quoted by
Rayer. Of these, two were horse-shoe shaped ; in six the two
kidneys were fused and the renal mass occupied the median
line ; in four others the two kidneys were probably fused, and
the renal mass was situated on one side or other of the spinal
column. In one of these four the renal mass was on the right side
of the spine, and had two pelves and two ureters, both of which
joined the right side of the bladder : Morgagni mentions this
case as one of unsymmetrical kidney, and not as resulting from
fusion. In six cases there was complete atrophy of one kidney,
the result either of defective development or of disease ; eleven
were cases of too doubtful a nature to classify ; seventeen were
cases of unsymmetrical kidney. In twelve of these seventeen the
corresponding ureter was absent : in ten of them it is distinctly
stated that there was no trace of the ureter, or words to that
effect ; in the other two it is mentioned that there was no
ureteral orifice in the bladder on the side of the absent kidney.
In the other five the ureter may, perhaps, be assumed to have
been absent because no mention of one is made.

In nine of the seventeen cases here included under " un-
symmetrical " kidney a doubt might be felt as to whether they

were not really fused or solitary kidneys; in four of them it is stated that the renal mass was "double size," "very large," or much larger than an ordinary kidney, but in none of the nine are any particulars given as to the ureter or ureters.

Twenty-two of the cases tabulated were in adults. Ten occurred in women, ten in men, and in three the sex is unstated.

Four were in young persons between four and fifteen years of age; three girls, and one boy aged four years.

Two were in fœtuses.

One was in a fœtal monster.

Seventeen cases are so recorded as to afford no information as to either age or sex.

Of these forty-six cases, in eight only is the single kidney stated to have been misplaced, namely, the two horse-shoe shaped, and the other six fused renal masses. These all occupied a position in the median line. In the other cases it is either stated or implied that the existing kidney was in one or other loin.

The forty-six cases show the various ways in which there may exist only one renal mass, and give a fair idea of the proportion the various forms bear to one another; but they do not in the least assist in answering the question, "How often, or in what percentage of cases, may we expect to find a single kidney?" Only the examination of a great number of post-mortem records can furnish the answer. I have attempted this, with the following results.

At Guy's Hospital in the ten years ending 1882, 4,632 post-mortem inspections were made, and only one case of congenital absence, or of an undeveloped rudiment, of one kidney was found. This was in a man, aged forty.

At the Middlesex Hospital in the twenty-four years ending 1897, 6,536 inspections yielded two cases of congenital absence, and one other, in which the left kidney was represented by a "mass of connective tissue."

At St. Bartholomew's in the ten years ending 1884, 3,800 medical post-mortems yielded no case of congenital absence, or undeveloped rudiment, of one kidney.

At the Hospital for Sick Children, Great Ormond Street, in the ten years ending December, 1884, the total number of post-

mortem examinations was 936, and amongst them was *one* case
of congenital absence of one kidney, and *one* of extremely defec-
tive development. The former occurred in a male, aged five
years and four months. The left kidney alone was present.
It weighed four and three-quarter ounces, which is about the
weight of two normal kidneys of a child of five and a half years
old. The pelvis and ureter were proportionately large. The
organ appeared to be quite healthy. There was no trace of a
right kidney or ureter, and no indication whatever of a ureteral
orifice on the right side of the bladder.

The case of extreme congenital atrophy of one kidney
occurred in a new-born male with imperforate rectum who lived
only five days. The right kidney measured one inch, and its
pelvis was much dilated ; the left kidney measured only one-
third of an inch, and was smaller than a haricot bean.

By adding the above figures together we have a total of 15,904
post-mortem examinations, yielding six cases of absence or extreme
atrophy of one kidney ; so that it would seem that the propor-
tion of cases in which congenital absence of one kidney is to be
looked for is once in every 2,650 cases.

That this estimate is not far from being correct I am
the more persuaded by the statements—apparently very wide of
one another—of Dr. Robert F. Weir of New York and Dr. O.
Petersen. Dr. Weir * states that "the single kidney is found
about once in five thousand bodies," and Dr. Petersen † says that
only once was the kidney wanting in 1,500 post-mortem
examinations of his own. By adding Weir's and Petersen's
cases together we get two cases of absence of one kidney in 6,500
bodies examined, *i.e.* one in 3,250, a proportion somewhat lower
than that in the London cases. Other investigators give a
somewhat greater frequency ; thus Sangali found three cases in
5,348 necropsies, and Menzies two cases in 1,790 necropsies ; but
averaging from my own and other statistics we find one case of
single kidney in 2,400 bodies examined.

The figures which I have obtained from the four London
hospitals and given above may be taken as representing the

* *New York Med. Journ.*, Dec. 27, 1884. Dr. Weir does not give the
data of his estimate.

† *Med. Times and Gazette*, Oct. 7, 1882.

proportion of cases of unsymmetrical kidney and of extreme congenital atrophy or defective development. They do not, however, represent the proportion of cases of horse-shoe kidney and other forms of fused kidneys, nor of kidneys atrophied by disease, nor those congenitally small or atrophied kidneys which weigh from an ounce or an ounce and a half upwards, and possess some though not a full amount of glandular substance.

I have referred in some detail to these deficiencies under the sections on malformed, atrophied, and horse-shoe kidney ; but for readiness of comparison the following figures may be repeated.   Nineteen horse-shoe kidneys were found in 18,244 examinations, *i.e* one for every 1,000 (about).   One fused kidney other than horse-shoe shaped occurred in 12,104 * inspections ; 59 " atrophied," " small," " shrunken," or " wasted " kidneys in 8,178 inspections.   This last number is in addition to the two cases of mere rudimentary kidney included above in the six cases of absent kidney.

The result of this investigation points, then, to the following conclusions : (1) The probability of a person having only one kidney owing to congenital absence or non-development of the other, is *exceedingly small.* (2) That there is a much larger risk of meeting with a horse-shoe shaped or otherwise fused renal mass ; and a very much greater risk still of finding one of the kidneys wasted or atrophied by disease. (3) That the fused kidneys are generally situated in the median line of the body. (4) That the presence of a renal mass in any abnormal position should be sufficiently suggestive of there being but a single kidney to prevent nephrectomy being performed without first ascertaining whether a second kidney is present or not.

It has been suggested that the non-development of one kidney is due to mechanical causes, such as pressure exerted by other abdominal organs during fœtal life ; but we have no definite knowledge on this subject.

In cases of a kidney wasted or atrophied by disease, the clinical history and characters of the urine would generally afford a guide and warning ; but despite all care there must sometimes

* The 12,104 are from Guy's, Middlesex, and the Children's Hospital. In the Bartholomew's Hospital cases no mention is made of such a case ; if these be added, then the proportion is one in 15,908.

be a risk in nephrectomy, whether abdominal or lumbar, of leaving behind no vestige of sound kidney tissue, if the operation is resorted to for certain classes of cases, such as tuberculous disease, and calculous pyelitis in which both kidneys may have been afflicted at some time or other.

Congenitally small kidneys are often healthy in structure ; but it is doubtful at present how long life could be sustained with only one ounce, or one and a half ounces, of healthy renal substance.   We know that we are endowed with much more than twice the quantity of renal tissue necessary for active and fairly vigorous life, but we do not know the minimum amount which is requisite for comfortable and active existence (*see* case by Eustachius, mentioned on p. 70).

A. " UNSYMMETRICAL KIDNEY."

This is the true type of congenital absence of one kidney. There is one normal, or at least functionally normal, kidney, and its fellow is altogether deficient.   The left kidney is more frequently absent than the right.   The corresponding suprarenal capsule is wanting in only about one out of every ten cases of congenital absence of the kidney.   On the other hand, two adrenal bodies may be attached to a misplaced renal mass, as in a case of Liebmann's, in which a single kidney with two adrenals associated with it was situated in the pelvis.

F. Craven Moore * in an analysis of 226 recorded cases of unsymmetrical kidney, says that it was absent in 32 and present in 83 out of 115 cases in which mention is made of it.

Situation.—The existing kidney may be situated in its natural position, or may be misplaced on to the spine at the pelvic brim, in the iliac fossa, in the true pelvis, or in some other direction.   Meckel has stated that when the kidney is situated in the pelvis it retains its lobulated and fœtal appearance throughout life.   This is not borne out by all the cases. Thus in Polk's case,† a young woman, nineteen years of age, had but one kidney, which was misplaced, and occupied the left iliac fossa.   It was fixed between the crest of the ilium and the brim of the pelvis, and was covered on its front surface by

* *Journal of Anatomy and Physiology*, April, 1899, p. 400.
† *New York Medical Journal*, February, 1883.

peritoneum. The left ovary lay directly upon the kidney. The ureter pursued its normal course in the pelvis to the bladder, and was about twice the natural size. There was no trace of a second ureter to this kidney, nor of a right kidney or right ureter. The organ was quite normal in structure, and *smooth on the surface.* So with kidneys lying on the sacrum.

There are instances in which it is very difficult to say whether the existing renal organ is an " unsymmetrical " or a " solitary " kidney, by " solitary " being meant a fusion of the two organs in which the fusion is complete. Neither the size of the renal mass, nor the number of the ureters, nor the manner in which the ureter opens into the bladder, can alone settle the doubt.

But setting aside all doubtful cases, there are a number of instances of "unsymmetrical kidney" occupying the **natural position in the loin.** Dr. Beadle informs me that in a male, aged forty-five, who died August 19th, 1897, in Lanark Asylum, he recently found an " unsymmetrical kidney " of nearly double the normal weight in the normal position. The left kidney and suprarenal capsule were absent. There was no left ureter, and there was a slight depression or pouching of the trigone of the bladder corresponding to the position of the opening of a normal left ureter.

The right kidney, which weighed eight ounces, was normal in appearance and position, had only one pelvis and ureter, which, however, was dilated to the diameter of about one-third of an inch.

The absence of one kidney gave rise to no symptoms, and there was no albumen in the urine.

Sir Dyce Duckworth * recorded the case of a woman whose right kidney occupied the right loin, but there was no left kidney or ureter. The right organ, greatly enlarged, weighing nine ounces, and measuring five inches in width at its central part, possessed one ureter, which passed to the right side of the fundus of the bladder, which it entered as usual.

Dr. Greenfield's (second) case † is one in which there was entire absence of the right kidney, renal vessels, and ureter, and also of the testis, vas deferens, and vesicula seminalis on the same

* *Path. Soc. Trans.,* vol. xx., p. 232.
† *Ibid.* vol. xxviii., p. 164.

side.   The subject was a male, aged fifty-nine, who died of extra-
vasation of urine and urinary fistulæ.   The left kidney was
slightly enlarged, but not misplaced.

In a case contained in *The Guy's Hospital Post-mortem Records*
the left kidney of a woman, aged forty, was entirely wanting, as was
also the left renal artery.   The right kidney was converted into
a large sacculated cyst of about double the size of the natural
kidney, and having only a thin layer (barely two millimetres)
of kidney tissue in its walls.   The sac was full of ropy pus and
coagulum ;   and the ureter was dilated to the size of the little
finger, its lining membrane being thick and warty.   The cause
of the pyo-nephrosis, for such it was, proved to be stricture of
the urethra and contracted thickened bladder.   Dr. P. W.
Macdonald * relates a case of absence of right kidney and ureter
in a female epileptic maniac, who died of phthisis.   The left
kidney was in its normal place, and had a single ureter of
ordinary size which opened into the bladder on the left side.
The kidney weighed nine ounces.

Dr. Turbin † of Tiflis has recorded an example of congenital
absence of the left kidney in a prisoner sixty years old.   The
ureter on the same side was absent.   At the site of its termi-
nation in the bladder there was a diverticulum a few centimetres
long.   The size of the existing kidney is not given.   Dr. Turbin
had collected eight cases from literature ;   five times the left
kidney was wanting, three times the right.   In O. Petersen's
only case in 1,500 post-mortem examinations (*Deutsche Medicinal
Zeitung*), it was the left kidney which was wanting.

I have the notes of two cases of congenital absence of
one kidney, *i.e.* "unsymmetrical" kidney; one was that of a well-
formed fœtus born at full time, the right kidney only being
present, and twice its natural size, and the ureter being much
dilated.   There was no trace of the left kidney, ureter, or vessels.
The second case was also one of a fœtus, born at full time,
and the right kidney only was present.   There was no trace
of the left kidney, ureter, or vessels.   The existing kidney was
simply a congeries of cysts.

Other similar cases in which the organ was not misplaced

* *Lancet*, May 30, 1885.
† *Amer. Journ. Med. Sciences*, Jan., 1883, p. 239.

might be quoted. Several such are included amongst Rayer's cases.

Mr. Gubbin * exhibited to the Sheffield Medico-Chirurgical Society a right kidney, weighing thirteen ounces, but otherwise normal, taken from a man, aged twenty-four, who died of hæmatemesis. The left kidney, ureter, and suprarenal capsule were entirely absent, and the left lobe of the liver weighed only a few drachms. Instances have been met with of single kidney twice the usual size in sheep, horses, and the common fowl.

Instances of an unsymmetrical kidney occupying **an abnormal position,** resting upon the lumbar vertebræ, the promontory of the sacrum, or sacral bodies, are less frequent than those which are situated in the loin.

Dr. M. Watson, in an interesting paper in the *Edinburgh Medical Journal*,† recorded a case in which the right kidney, with its ureter, was entirely absent, and there was no trace of the entrance of a ureter into the bladder of that side, the mucous membrane being quite smooth. The left kidney, which was not larger than usual, was circular in form and lobulated on the surface (thus corroborating Mæckel),‡ and was situated close to the brim of the pelvis, in front of the common and external iliac arteries of that side. The left ureter was much dilated at the hilum, and nearly double the normal size, except at the point of entrance into the bladder, where it was quite natural. This unusual position of the kidney had forced the distended bladder towards the opposite side of the pelvis. The artery to this kidney came off from the fork of the aorta, and entered the upper end of the kidney after dividing into two trunk branches.

Size.—It has been stated many times that when there is only one kidney it always exceeds the natural size. But this, though fairly constantly, is not invariably, correct. An unsymmetrical kidney, like a renal mass composed of two kidneys closely fused together, may be either of much greater magnitude than the normal kidney, or not at all in excess of the normal. Care must be taken not to confuse genuine hyperplasia with

* *Brit. Med. Journ.*, Jan. 20, 1883.
† July, 1874, p. 13.
‡ *See* p. 41, *ante.*

enlargement of a "single kidney" from disease. When an "unsymmetrical kidney" is enlarged and the enlargement is not due to disease, the increase in size is really a hyperplasia or increase in the number of the elements, not a hypertrophy or increase in the size of the individual elements of the organ (Craven Moore).

Age.—Cases are met with in the foetus, and at all ages up to eighty years and upwards. Newman * gives the ages of 17 cases of single kidney found in persons who died after the age of sixty years, 8 of them being over seventy and 2 over eighty.

Sex.—Single kidney has been found almost twice as often in males as in females.

Shape.—The natural shape of the single kidney is commonly maintained, or, if at all, it deviates only slightly from the normal; in some cases, however, it has been found "rounded," "globular," "quadrilateral," "lobulated," or otherwise abnormal in outline.

Vessels.—The renal vessels of the single kidney are sometimes increased in number, or size, or in both. If the unsymmetrical kidney is also misplaced the vessels are commonly derived from the iliac or middle sacral artery. On the side on which the kidney is absent the vessels are also absent, or merely rudimentary, running into the fatty tissue or adjacent lymphatic glands.

Ureter.—The renal pelvis and the ureter, as a rule, are normal. There are, however, many exceptions to this rule. In most cases the ureter is absent on the side of the defaulting kidney, and when present it is fibrous or rudimentary or present only at its lower extremity. Asymmetry of the bladder has been occasionally observed, the ureteral orifice and the plica ureterica being absent.

Number of ureters in "unsymmetrical" and "solitary" kidney.—As to the ureters, it is most frequent in fused kidneys to find two pelves and two ureters, which pass down to the bladder, there to enter in the usual manner ; but, on the one hand, in some clear instances of fusion of two kidneys there has been only one ureter, which has entered the bladder in the mesial line ; and, on the other, there are instances where two kidneys were present, one of which had two separate ureters which either united before reaching the bladder, or entered separately

* *Medical Press and Circular*, vol. i. (1899).

into the same side of the bladder, whilst the ureter of the opposite kidney entered as usual on its own side of the bladder (*see* Vol. II., Part II., Chapter II.).

When a single kidney, whether of ordinary size or of much greater dimensions, has a single ureter entering the corresponding side of the bladder, there can be no doubt of its " unsymmetrical " character. When a renal mass with faint or marked traces of separation into two masses has two ureters, which enter in the usual situations, one on each side of the bladder, there can equally be no doubt of the " solitary " mass being the result of the fusion of two kidneys. But between these types there are all degrees and variations ; and a difference of opinion as to the congenital absence of one kidney, or the congenital fusion of the two, may therefore possibly arise. There is great room for doubt in a case recorded by Ogston in the *British Medical Journal* (1879, vol. i., p. 591) in which a ureter passed down to the opposite side of the bladder from a cyst attached to the lower end of the only existing kidney. This seemed to be a fused kidney mass composed of a normal kidney and a misplaced and very hypoplastic organ ; yet in favour of its being an " unsymmetrical " kidney is the fact that the genital passages and ovary on the side of the defective kidney were absent.

Morgagni describes the case of a woman who died of dysentery, and whose body was dissected by Valsalva ; the left kidney was altogether deficient, but the deficiency was supplied by the right kidney, which was twice as large as natural, and was furnished with a double pelvis and ureter. *Both the ureters went to the right side of the bladder.*

Morgagni also mentions the cases of Panarolus and Laubius (also referred to by Rayer) as instances in which one kidney only was formed, and was lying on one side of the spinal column as usual, *i.e.* like an ordinary " unsymmetrical " kidney ; but he adds that there were two pelves and two ureters, and that one of the ureters inserted itself into that part of the bladder to which no kidney corresponded, thus differing from the arrangement met with in the woman dissected by Valsalva.

It would thus seem that in these two cases (of Panarolus and Laubius) the condition was more like fusion of the kidneys, in which the " solitary " organ was lying on one side of the spine,

than " unsymmetrical " kidney. Morgagni, however, includes them in the class which Rokitansky has named " unsymmetrical."

Morgagni refers to no less than nineteen other cases, which he classed under the same heading ; but many of them are merely described by their reporters as instances of " one kidney only " ; in some of these examples the renal mass seemed to be made up of the two kidneys.

Associated Deformities.—Congenital absence of one kidney may be associated with other defective developments. A case has been reported by Edridge-Green in which a congenital absence of the right kidney was associated with absence of the Fallopian tube and ovary on the same side and the presence of two thumbs on the right hand and two accessory auricles. Craven Moore says that in 33 per cent. of 226 cases collected by Ballowitz and others, more or less extensive congenital defects of the genital organs are recorded. In males, absence of the vas deferens, vesicula seminalis, and ejaculatory duct on the same side has been met with most frequently ; an atrophic state or even a complete absence of the testis on the same side has been observed in a very few instances, as in Craven Moore's case, and presumably in a case reported by Greenfield in the Pathological Society's *Transactions* (vol. xxviii., p. 164). In the female, uterus bicornis has occurred most frequently ; septate uterus with duplication of the vagina, uterus unicornis, absence of the Fallopian tube, absence and atrophy of the ovary, have been observed. Sir W. Turner, M. Exhaquet, Voelcker, and others, and, more recently, N. Bishop Harman (*Journal of Anatomy and Physiology*, vol. xxxii.), have reported cases of absence of one kidney and its vessels, associated with uterus unicornis.

B. " SOLITARY " KIDNEY, OR THE FUSION OF TWO KIDNEYS INTO ONE.

It has been shown in the preceding statements that there may be two kidneys in the body, but only one of them occupying the loin, the other organ being movable or misplaced ; even both may be movable or misplaced. But when both are misplaced they are generally more or less united.

We have now to consider in some detail the various degrees in which the kidneys may be fused into one mass.

Rokitansky has well described the two extreme degrees of fusion in the following words : " The lowest degree of fusion is seen in the horse-shoe kidney (ren unguliformis) ; the two kidneys are united at their inferior portions by a flat riband-like or rounded bridge of tissue, which crosses the vertebral column. In the higher degrees the two lateral portions approach one another more and more, until they reach the highest degree,
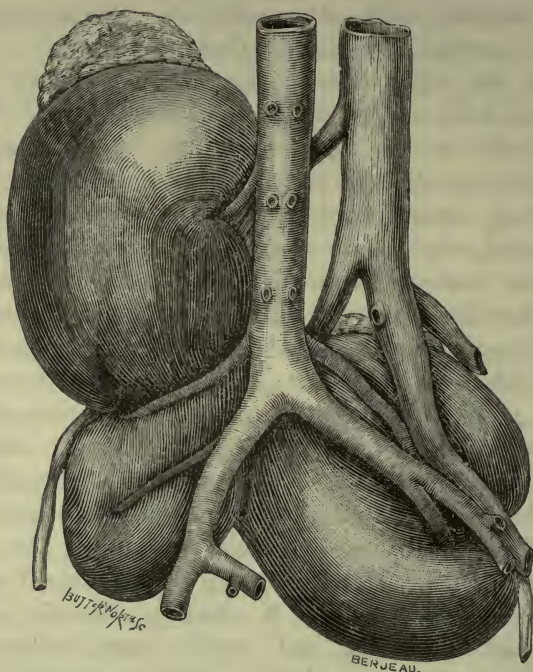
Fig. 11.—Fused Kidneys. (Guy's Hospital Museum, No. 1583.)

in which a single disc-like kidney lying in the median line, and provided with a double or a single calyx (pelvis), represents complete fusion."

Fig. 11 shows the two kidneys fused, displaced, and turned with their hila away from each other; the left shows an hour-glass constriction. The blood-vessels are abnormal. The fusion is but slight, and each organ has its own vessels and ureter.

An excellent example of an intermediate degree of fusion

is described by Dr. Coupland. The general configuration is that
of the normal left kidney, but with traces of lobulation (*see*
Fig. 12). The upper and larger part of the mass is formed by
the left kidney ; the lower and smaller part, which is less than
half the size of the upper, represents the right kidney ; whilst
the elongated central portion between the two ureters represents
the renal tissue which usually unites the right and left halves
of a horse-shoe kidney. The convex border of the upper part,
i.e. of the representative of the left kidney, looked upwards and
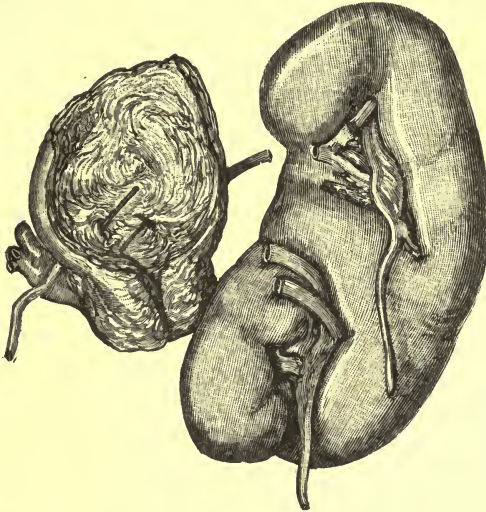
Fig. 12.—Fused Kidney; and the Bladder from the same subject, showing the normal
Orifices of the Ureters. (Preparation in the Middlesex Hospital Museum.)

to the left ; the convex border of the lower part, *i.e.* of the
representative of the right kidney, looked towards the median
line, and therefore towards the right, as it normally does. In
the hilum of the left organ the ureter was in front of the renal
vessels ; in the hilum of the right organ the ureter and renal
vessels have the normal relations to one another. Both ureters
pass down in front of the organ, as is usual in horse-shoe
kidney. The right ureter crossed the middle line about the brim
of the pelvis, and opened at its usual place into the bladder.
The bladder, with the orifices of the ureters, is also seen in the
woodcut. The whole renal mass weighed $6\frac{1}{2}$ ozs., and measured
$6\frac{1}{8} \times 3\frac{1}{8}$ inches.

This is a good example of what may be regarded as a transitional form of solitary kidney, *i.e.* of a form holding an intermediate position between the horse-shoe kidney and that in which no indication of a division into two parts can be discovered externally, except perhaps by a bridge of renal tissue between the distinct and non-communicating pelves of the two ureters.

A very similar specimen to that described by Dr. Coupland is reported and illustrated in Virchow's *Archiv* for November, 1884.

Under the title of a case of congenital **S**-shaped fusion of both kidneys, Dr. G. Broesike of Berlin describes* a condition which, as distinct from the more usual " horse-shoe " kidney, he calls the " ren sigmoideum," from the resemblance of the congenital organs to the Roman letter **S**. The union in this preparation (Fig. 13) occurred between the upper extremity of the right kidney and the lower end of the left, the latter alone retaining its normal situation in the body; the right kidney thus lay wholly to the left of the middle line, and at first sight it was thought to be a case of complete absence of this organ.

The subject from which the preparation was made was a well-nourished male adult. It is not recorded whether the right adrenal was present; but the site of the kidney was occupied on this side by a considerable quantity of fat. The left adrenal lay on a level between the eleventh and twelfth dorsal vertebræ; and the left kidney occupied nearly a normal position. Its hilum was markedly excavated, its vessels consisting of a much-divided renal artery and a single vein, the latter passing normally in front of the aorta. The origin of the ureter lay behind the vein, and between the arterial branches. United by renal substance to the lower end of this kidney was the right organ, which occupied a deeper but otherwise similar situation to what it would have had on the right side. Its hilum was thus directed to the left, its convex border being to the right, *i.e.* towards the median line. This second and deeper-lying kidney was smaller than the other, and clearly marked off from it by an oblique furrow traversing the anterior surface, and lodging the left ureter in its passage downwards and outwards. Posteriorly there was no indication, on the smooth surface, of a

* Virchow's *Archiv*, xcviii., p. 338 (November, 1884).

division between the congenital organs. The whole of this
" double kidney " had an **S**-shaped form, and extended on the
left side of the vertebral column from between the eleventh and
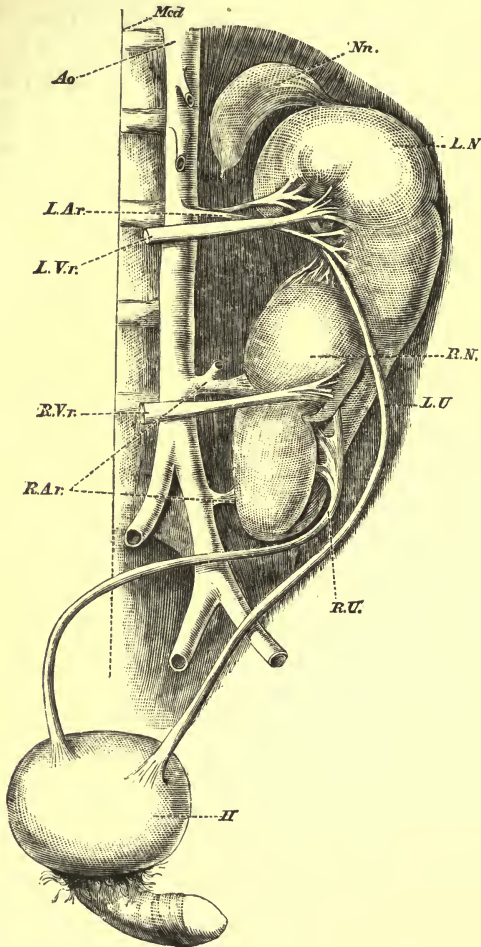
Fig. 13.—Fusion of two Kidneys in **S**-shaped manner. (Virchow's *Archiv.*)
Med, Median line; *Ao*, aorta; *Nn*, suprarenal capsule; *L N*, left kidney; *R N*, right kidney; *L U*
left ureter; *R U*, right ureter; *L Ar*, left renal artery; *L Vr*, left renal vein; *R Ar*, right
renal arteries; *R Vr*, right renal vein; *H*, urinary bladder.

twelfth dorsal vertebræ to the middle of the last lumbar. The
hilum of the lower (right) kidney was somewhat deeply exca-
vated. The renal vein passed out above the ureter in front of

the organ, and crossed in front of the aorta.   The arterial supply
was by two trunks, one of which arose from the aorta, about
three centimetres above its bifurcation, and entered the convex
border of the organ ; the other came from the left common
iliac artery, and terminated near the lower border of the hilum.
From the upper of these arterial trunks sprang a tolerably large
vessel, probably the inferior mesenteric.   As regards the ureters,
the left, after passing along the furrows between the conjoined
organs, ran downwards close to the hilum of the lower kidney,
and thence in its usual course to the base of the bladder.   The
ureter of the lower (right) kidney, after a short course close
to and parallel with the foregoing, passed transversely across the
median line opposite the first sacral vertebra to the right common
iliac vein, and thence took its normal direction on the right
side of the pelvis to the bladder.

Dr. Broesike, in a few remarks on fusions of the kidneys,
says that Mæckel's (1812) original hypothesis of their origin in
an arrest of development, although more recently adopted by
Mühlhäuser (1861), has been disputed by Schultze, and also by
Friedlowsky (1869), who, on the ground of cases of his own,
and the investigations of Küppfer (1865), concluded that the
kidneys must first be developed separately, the fusion and change
in site being a secondary occurrence, taking place during fœtal
life.   The case above described accords better with this latter
doctrine.   For, according to Küppfer, the permanent urinary
system of mammals arises in the form of the so-called "renal
canals," as blind offshoots from the posterior. wall of the Wolffian
ducts.   These offshoots subsequently form the ureters and renal
pelvis, and around the latter are grouped cells which eventually
constitute the renal parenchyma.   The "renal canals" necessarily
undergo many changes in position, so that for a certain time
both kidneys lie in front of the bifurcation of the aorta, and
rest with their concave margins close together.   To interpret
the case described, one must assume that the normal changes
of position did not take place equally on both sides, in that the
right "renal canal" remained behind the left in its development,
so that at a certain time the two kidneys, instead of being pre-
cisely facing each other, came to occupy different levels.   At
this early stage the kidneys are composed of separate lobes (the

renculi), and in their subsequent fusion to form the kidney it is conceivable that the lobes of both kidneys became united into one mass. This implies that the altered position of the organs preceded their conjunction.*

Vaughan has recorded a case in which the two kidneys were fused at right angles to each other and formed an L-shaped mass on the right side; the vertical portion was in its usual position, with its hilum on the inner side, but the horizontal portion apparently lay on its back, with its hilum on the anterior surface, and extended two centimetres across the aorta just above its bifurcation. The mass was grooved in such a way as to suggest its division into five lobules.†

There are other forms of the solitary kidney; e.g. there are in some cases four lobules or masses, looking like a quadruple instead of a double kidney (Fig. 14, Botallus's case). Oleson of Chicago has recorded a somewhat similar case in a young adult in whom a horse-shoe kidney was accompanied by two adventitious kidneys: these latter were turned with their hila directed obliquely outwards and downwards, and their inferior margins were continuous across the front of the aortic bifurcation. Each of these four kidneys was anatomically and apparently functionally perfect, with pelvis, ureter, vein and artery, and they only differed from normal kidneys in fusing imperceptibly into each other.‡ The ureters on each side arose normally from a perfect pelvis, passed vertically down behind the kidney tissue, and drained the pelvis of the other kidney on that side by an opening at its most dependent portion, continuing thereafter in its normal course.

In other instances again the two organs are fused into an unshapely mass, as in a specimen with a double ureter, mentioned

* Dr. P. W. Macdonald (*Lancet*, May 30, 1885) figures a solitary kidney having the general shape of the ordinary organ, but which on section " seemed to be one large kidney, with a smaller one joined on to its upper end. The smaller pelvis had separate and distinct pyramids." The renal mass weighed 11½ ozs.; it had two ureters and two pelves. The ureters entered the bladder normally; the one from the smaller pelvis passed behind the other to enter the bladder as the right ureter. This kidney was situated on the spinal column, and rested on the second, third, and fourth lumbar vertebræ.

† G. Tully Vaughan, *New York Med. Journ.*, 1897, vol. ii., p. 659.

‡ *Annals of Surgery*, 1894.

by Wilks and Moxon as having been removed from the pelvis, not the abdomen, of its possessor.

The solitary kidney, then, is a compound organ, composed of two kidneys fused together; one of these at least must be, and very generally both of them are, misplaced.

Fig. 14.—Fusion of Kidneys. The fused mass has a quadruple appearance. (*After Botallus.*)

A, Aorta; v c, vena cava; R A, renal arteries; I A, iliac artery; H A, hypogastric artery; R v, renal veins; UR, ureters.

Solitary kidneys may be classified, according to their degree of fusion, into

1. Horse-shoe kidney;
2. Intermediate varieties;
3. The completely united, or disc-like kidney.

As a rule, each of these forms of solitary kidney has at least two ureters. Sometimes, however, though with exceptional rarity,

when the two kidneys are united over the promontory of the sacrum, there is only a single ureter.

In a case related by Delafield* the solitary ureter opened into the bladder in the median line.† It is not, however, quite certain, from Delafield's own account, that this was a fused renal mass, and not an unsymmetrical kidney ; though most probably, as Wilks and Moxon have assumed, it was an instance in which the two kidneys were united.

In each form of fusion of the kidneys the hilum is directed forwards, and the ureters descend over the front of the organ.

Rokitansky says : " The more intimate the union is, the more the hilum of the kidney is directed forwards, so that whereas in the lowest degree it is indicated by an evidently increased development of the posterior labium of the hilum, the hilum in the highest degree of fusion occupies the anterior surface of the solitary kidney."

The same observer also remarks, that the more considerable the fusion is, the lower are the kidneys situated ; so that the completely fused organs are commonly placed over the promontory or in the concavity of the sacrum.

He was quite aware, however, that the "solitary" kidney, like the "unsymmetrical kidney," may be situated on one or other side of the vertebral column ; but only in " exceptional cases."

Cruveilhier ‡ says : " It is not very uncommon to find only one kidney, which is almost always formed by the union of the two by means of a transverse portion crossing in front of the vertebral column, and having its concave border directed upwards. Sometimes the two united kidneys are situated in the right or left lumbar region, or in the cavity of the true pelvis."

Wilks and Moxon speak of having seen two kidneys on the right side and none on the left, but they do not state whether there was fusion or not.

1. **The horse-shoe kidney.**—This is the commonest form of fusion of the kidneys as well as the most frequent of the permanent misplacements of the kidney.

* Delafield's " Post-mortem Examinations and Morbid Anatomy," p. 206.
† Wilks and Moxon, p. 497.
‡ " Traité d'Anatomie Descriptive."

Cruveilhier, in the passage just quoted from his treatise on descriptive anatomy, refers to it as "not very uncommon"; and Velpeau says, "I have frequently found the two united in front of the spine."*

In a typical example the two kidneys are united at their lower ends by a mass of renal substance of varying thickness, which in the large majority of cases passes in front of the aorta, but occasionally it has been known to pass between that vessel and the vertebral column, as in a case reported by Nixon †. The
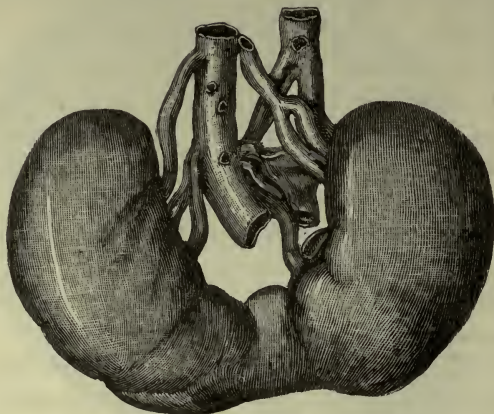
Fig. 15.—Horse-shoe Kidney, seen from behind. (Middlesex Hospital Museum.) Each kidney receives two large arteries, which spring from the aorta with an interval of 1½ in. between their points of origin.

connecting band of renal tissue forms a curve with the convexity almost invariably directed downwards; the kidneys, throughout their extent, are much nearer the spinal column than normal, and at their junction rest across the vertebral column; they are also situated more horizontally and lower down than normal. The ureters, usually two in number, as a rule pass over the front of the renal isthmus, and end normally in the bladder.

There is a double set of arteries and veins, as would be expected, in the fusion of two healthy kidneys (see Fig. 15); but the arterial supply in these cases is very variable both in number and mode of origin, and frequently differs on the two sides. Struthers has reported a case in which there were two

* "Treatise on Regional Anatomy," p. 236. Translation by Hancock.
† *Med. Press and Circ.*, vol. xliii.

arteries for each lateral lobe and one for the isthmus.* When there are more than two arteries it often happens that one or more of them arise from the common iliac.† Cotton has recorded a case in which there were no renal arteries proper at all; a few twigs only entered from the aorta, and the main supply apparently came from underneath the organ.

Though this is the most ordinary type of horse-shoe kidney, instances are met with in which one or other of these characters is modified. The upper ends instead of the lower ends of the kidney may be joined together, and then the concavity instead of the convexity of the curve is downwards.

Morgagni refers to two instances in which the convexity was upwards, one being in a monster (Winslow's case).

Mæckel ‡ says that in rare cases the concavity is downwards.

The bond of union may be either fibrous or glandular. Sometimes it is thin and flat, being little, if anything, more than fibrous tissue; in other cases a thin broad layer of renal substance, with a vertical groove in front and behind, joins the two organs; or a narrow band of renal tissue is the uniting medium.

Francus described the isthmus in his specimen as being " of very great vastness and amplitude."§

Rayer, who stated that he had seen many examples of horse-shoe kidney, gives particulars of three, in each of which the isthmus was placed across the vertebral column. In one, the two kidneys were united below by a flat band of renal substance; ‖ in a second case the uniting band was larger, and approached a little more in appearance the form of a small kidney; whilst in the third case there was a distinct kidney uniting the other two, each of which was equally distinct in outline.

He enumerates thirty-four authors who have narrated cases of horse-shoe kidneys. Several of these are referred to by Morgagni, and some of them have been quoted by almost every writer since Rayer's time.

The ureters may pass behind instead of in front of the semicircular mass; this is, however, very rare.

* *Journ. of Anat. and Phys.*, vol. xxviii., p. 303.
† Path. Soc. of Brooklyn, 1884.
‡ Path. Anat., i., s. 616.
§ Morgagni, Letter xlviii., art. 16.
‖ Atlas, p. xxxix., Fig. 2.

Wilks and Moxon are alone in stating that the ureters, *as a rule*, pass down behind ; but Durham * refers to a case described in the post-mortem register of Guy's Hospital for 1859 (No. 36), in which "the ureters passed behind the organ." "This," Durham says, "was a very good example of the 'horse-shoe kidney.' It weighed thirteen ounces and a half ; and was formed, as usual, by the lower ends meeting over the spine, thus making the convexity downwards. The structure was healthy."

Though usually there are two pelves and two ureters, and a corresponding number of arteries and veins, there are exceptions to this also.

Monquiot † found a kidney from seven to eight inches long placed transversely across the lumbar vertebræ, which had four pelves, four ureters, and as many arteries and veins.

There is a specimen in St. Mary's Hospital Museum having three ureters, two belonging to one half and one to the other.

Roberts mentions a specimen in which the two ureters of a horse-shoe kidney crossed each other on their way to the bladder.

Gebhard ‡ saw a case in which one of the two ureters of a horse-shoe kidney had five branches ; the other ureter was simple.

Other variations in the horse-shoe kidney occur.

In one of Sandifort's cases (*see* Rayer) the left part of the horse-shoe kidney was larger than the right ; but both had more arteries than normal.

Sandifort,§ in a second case, found in a male subject the left kidney absent from the left loin ; it was placed on the right side below the right kidney, with which it was united into a crescent (horse-shoe), and with which it formed an extraordinary shape.

Morgagni's case was a girl, aged six, who had a solitary kidney differing from most in this, "that the right lobe was distant from the left by no very great interval, the right being laid upon the left in the lower part, and divided with a sulcus on its anterior surface alone, so that an isthmus was formed not less slender than the lobes."

The frequency of horse-shoe kidney may be judged of by

---

* *Guy's Hospital Reports*, 1860, p. 407.
† *Journal des Savans*, 1878, Mai 16 ; and Rayer, vol. iii.
‡ *Vide* Rayer, vol. iii., p. 771.
§ *Ibid.*

the following figures : Of a total of 18,244 examinations at Guy's, St. Bartholomew's, the Middlesex, and the Hospital for Sick Children, Great Ormond Street, the records of which have been looked over for the especial purpose, there were nineteen instances of horse-shoe kidney, or about one in every 1,000 post-mortems.

There are many specimens contained in pathological museums. In 1861 Dr. Gibb * looked through the London museums and found nineteen specimens which present various anomalies in regard to number of ureters and renal arteries. Others may have been added since. But neither museum specimens nor the records of cases in the *Pathological Transactions* can furnish the relative frequency of the abnormality. The above figures, however, help to do this. Oleson states that the case of anomalous horse-shoe kidney described above (p. 53) was the only case of horse-shoe kidney he met with in 507 recent necropsies ; whereas he found in the same post-mortem subjects three cases of renal malposition all affecting the right kidney, which in each instance lay at the margin of the false pelvis.

2. **The intermediate variety** of solitary kidney is typified in the cases already referred to, by Dr. Coupland and Dr. Broesike, the shapes of which are seen in Figs. 14 and 15. Ebstein describes such-like cases under his second form of "*fusion of two kidneys at single points.*" He says : " In the second form the union takes place in the middle by the two hila. In slight grades of the anomaly it is only a small connecting bridge which unites the kidneys with one another. The highest grade has been observed by Mæckel,† but even in that case the upper and lower ends were separated. In a few exceedingly rare cases the supernumerary renal parenchyma is not united to the two kidneys, so that the middle piece constitutes an independent kidney, which receives blood from both the lateral parts, but also possesses in part independent vessels." ‡ In this variety the fused kidneys may occupy the normal position of one of them, as in Coupland's case and Virchow's ; or the partially fused mass may be misplaced altogether either to the middle line of the abdomen or into the pelvis.

* *Path. Soc. Trans.*, vol. xiii., p. 133.
† Path. Anat., vol. i., s. 616.
‡ Ziemssen, vol. xv., p. 777.

An interesting example of the intermediate variety is included amongst the cases of which I have the notes. It occurred in a man who died in Guy's Hospital. The two kidneys formed an irregularly shaped mass which weighed thirteen ounces, and was lying on the front of the promontory of the sacrum. It was not horse-shoe shape, and the vessels and ureters were arranged most unusually. The central part of the mass was fissured by a sulcus, in which the ureter for the left kidney coursed downwards and the vein for the same upwards, passing into the vena cava just above the junction of the two iliacs.
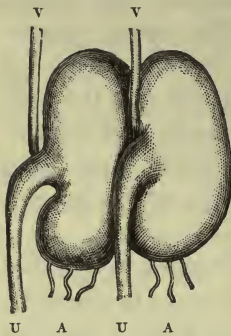
Fig. 16.—Diagrammatic.
u, Ureters; a, arteries;
v, veins.

In the right half of the mass the ureters and vessels, instead of being situated centrally, were on its outer side; the ureter being in front of the vessels as in the left, and as is usual in fused kidneys. The arterial supply consisted of two or three arteries for each half of the mass about the size of the radial artery which were derived from the common iliac arteries, and entered the lower part of each kidney (see Fig. 16). The suprarenal capsules were in their normal positions. The renal substance, to the naked eye, was healthy.

3. **The completely united variety of solitary kidney** is that in which the two organs approach one another so completely that they form a single disc-like mass provided with a double or a single pelvis. It is what Rokitansky called the "highest degree" of fusion of the two kidneys. These completely fused organs sometimes lie in the median line over the lumbar vertebræ or the promontory of the sacrum, or in the hollow of the sacrum; but this is not nearly so uniformly the case as it is with the horse-shoe variety, the isthmus of which commonly rests across the lumbar vertebræ.

In 1756 Haller illustrated a specimen of complete fusion of the two kidneys (Fig. 17); the mass occupied the median line, and possessed two ureters; its arteries were derived from the aorta, iliac, and spermatic.

Dr. Greenfield * has described a case in which a kidney mass

---

* *Path. Soc. Trans.*, vol. xxviii., p. 162 ; case 1.

weighing seven and a half ounces, and measuring five inches
in length, occupied the normal position of the left kidney. The
general outline of this mass was nearly like the left kidney,
though flatter and wider at the lower part. It was slightly
lobulated, but there was no indication of division into two parts.
The hilum was on the anterior surface and much farther out-
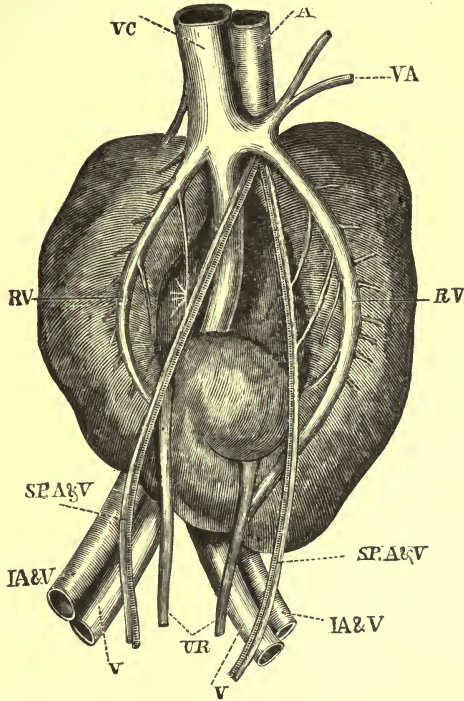
Fig. 17.—Two Kidneys blended, and occupying a median position. (*After Haller.*)
A, Aorta; V C, vena cava; V A, vena adiposa; R V, renal vein; S P A & V, spermatic artery and vein;
I A & V, iliac artery and vein; UR, ureters; V, iliac vein.

wards than usual, and was divided into two distinct parts, upper
and lower, separated by a bridge of kidney substance. The two
ureters and their pelves were quite distinct, and did not com-
municate in the organ. The upper passed somewhat inwards
in the usual direction, and then downwards. The lower passed
nearly vertically downwards in front of the organ, lying in a
furrow on the anterior surface, which produced a sort of
bifid extremity. On cutting into the organ a faint line of

demarcation, running obliquely across it, seemed visible at first, but was lost after the organ had been kept in spirit. There were two distinct sets of uriniferous tubules and pyramids. The structure was healthy. The ureters entered the bladder as usual, one on each side. The artery was single and in the normal position of the left renal artery, but it divided near the hilum into two trunks, which gave branches to the two divisions. The suprarenal capsules were normal. Lee Dickinson has also related a somewhat similar case in which there was no kidney on the right side, while the left resembled two kidneys joined together longitudinally, the fusion being complete. There were two ureters, the upper of which entered the bladder on the right side.*

Dr. Kelly † has recorded a very remarkable case in which *a right-sided* kidney mass in a female was lying vertically along the spine, having a convex outer border. It weighed ninety-three ounces. There were three arteries and two ureters. The upper ureter descended in the usual manner, and was situated most anteriorly in position in front of all the vessels; the lower one, after passing behind it, followed the course of the left common iliac artery, and entered the bladder in the usual place.

Sir Dyce Duckworth ‡ mentions a specimen which was in the Pennsylvania Hospital Museum, of a renal mass which was situated on the right side of the pelvis instead of in the abdomen; it had two ureters, which entered the bladder at the usual places, and two renal arteries. The general outline of the mass was circular.

Dr. Butler has figured a case of fused kidneys of elongated form which reached from the body of the fourth lumbar vertebra to the middle of the sacrum. It measured five inches in length by three and three-quarters in breadth; it had a central longitudinal fissure or raphe better marked behind than in front, and two ureters, terminating at the bladder in the usual manner, but united above in a single pelvis which was attached to the middle of the anterior surface of the renal mass. Four arteries supplied the mass: one large trunk from the fork of

* *Trans. Path. Soc.*, vol. xlvi., p. 80.
† *Trans. Path. Soc.*, vol. xix., p. 274.
‡ *Trans. Path. Soc.*, vol. xx., p. 233.

the aorta, two from the left internal iliac, and one from the right internal iliac.

There is a single renal mass in St. Bartholomew's Hospital Museum twelve inches long.

In Dr. Delafield's case the two kidneys were united over the promontory of the sacrum, and there was only a single ureter which entered the bladder in *the median line*. In a case mentioned by Wilks and Moxon the two kidneys were united into an unshapely mass which lay in the pelvis.

Morgagni * gives a case (Valsalva's), already referred to, in which both ureters went to the right side of the bladder. It was in a woman who died of dysentery, and who had no left kidney; but this deficiency was supplied by the right, which was twice as large as natural and had two pelves as well as two ureters. It is doubtful whether this should be regarded as a " fused " or an " unsymmetrical " organ. Craven Moore refers to it as an example of a double abnormality, namely, " unilateral aplasia with complete duplication of the ureter and pelvis on the opposite side, and not fusion."

C. ATROPHY OF ONE KIDNEY.

Atrophy of the kidney may be either congenital, or the consequence of disease.

Diagnosis between congenital absence and congenital atrophy or imperfect rudimentary development.—Congenital absence of one kidney must not be confounded with congenital atrophy, or, more properly speaking, rudimentary development of one kidney. Clinically, and to the surgeon who is contemplating nephrectomy, their importance is practically the same. It is sometimes difficult to say whether there is congenital absence or congenital atrophy. For instance, Ebstein tells us that he found, in a man, aged twenty-four, whose left kidney was greatly hypertrophied, " a pale reddish mass of connective tissue, surrounded by considerable adipose tissue," at the upper end of the right ureter. " This mass was smaller than the norma suprarenal gland; no glomeruli and no uriniferous tubules could be discovered in it "; yet a very narrow ureter and renal pelvis, as well as a very small representative of the renal artery,

* Letter xxxi., art. 25; xlviii., art. 16.

were connected with this mass. Ought this to be considered a specimen of atrophied kidney, or of congenital absence of the kidney with the pelvis and ureter of that side imperfectly developed? Ebstein regards it as an instance of congenital atrophy, and this opinion is probably the right one.

Morgagni agreed with the doctrine of Aristotle, which is that the kidney has been congenitally *absent* in cases in which no vestige of either emulgent vessels or ureter or kidney exists, as was the case in a little girl dissected by Poupart, and in the priest, and in the woman dissected by Valsalva; and he formed the same conclusion regarding cases in which, though some trace of ureter or emulgent vessels is present, there is evidence in the great size and double pelvis and ureter of the existing kidney to show that it was Nature's intention from the beginning that the functions of two kidneys should be discharged by a solitary renal mass. He further considered that there is evidence of congenital *absence* of kidney, even though neither ureter nor emulgent vessels were wanting, when nothing but fat occupies the renal region. He found such a condition in a healthy whelp which he dissected in Bologna in 1702. The ureter, though joined with the bladder, was but a solid cord ending above in slender striæ, just before it reached the fat; and the emulgent artery, much smaller than natural, ended in small ramifications which only crept through the fatty tissue above described.

In a large majority of cases in which one kidney is absent we find the ureter absent too, but when a rudimentary kidney is present, no matter how rudimentary the minute mass may be, either the upper or lower end, if not the whole, of the ureter is generally more or less developed.

This accords with Valentine's teaching, "that the ureter, the pelvis of the kidney, and the uriniferous tubules are formed in a general blastema, independently of one another," and with the descriptions of recorded cases. Craven Moore believes the cause of the malformation is directly related to the Wolffian duct and its offset—the metanephric duct. If complete aplasia of the Wolffian duct obtains, the vas deferens and the ureter, the renal pelvis and renal tubules, are absent; but if the development of the Wolffian itself has proceeded, but short of giving rise to the offset which would have eventually formed the metanephric duct,

develop from the metanephric duct (ureter, pelvis, renal tubules) fail. If the metanephric duct is rudimentary the ureter will be so also, or the duct may be fully formed but fail in its subdivision into tubules.

I have noted the presence or absence of a ureter in all the cases (1) of atrophy of one kidney, and (2) of unsymmetrical kidney, which have been recorded in the fifty volumes of the *Transactions* of the Pathological Society; there are ten instances of atrophy, in seven of which the corresponding ureter was more or less developed, while in the other three there was no note about the ureter; there are seven instances of congenital absence of one kidney, and in only one of them was the ureter stated to be present; in four there was no trace whatever of ureter, and in two it is stated that even the ridge bounding the trigone of the bladder, and on which the ureter normally opens, was wanting; in the remaining two the condition of the ureter was not stated. In twelve out of seventeen "unsymmetrical" kidneys in Rayer's list the corresponding ureter was absent (*see* analysis of Rayer's cases given on page 37 *supra*).

Dr. M. Watson [*] gives the post-mortem notes of a man who was the subject of epileptic attacks. The left kidney was larger than usual, and weighed nine and a half ounces, whilst the right was reduced to the size of a large bean, measuring an inch and a half by one inch. This little mass was situated in the usual position of the right kidney, but presented to the naked eye on section no trace of any subdivision into cortical and medullary substance. Microscopically it was composed of fibrous tissue, with here and there isolated tubes much larger than the ordinary renal tubules; these tubes were filled with cells and connected with what appeared to be well developed Malpighian capsules. The persistence of the tubules and Malpighian capsules is the more noticeable because there had never existed any outlet for their secretion. The ureter had no connection whatever with this rudimentary kidney; though pervious at the bladder, it degenerated into a fibrous cord in the neighbourhood of the kidney, and was lost in the loose subperitoneal connective tissue before reaching the atrophied organ.

[*] *Edinburgh Medical Journal*, July, 1874, p. 15.

Is atrophy congenital, or induced by disease ? — The pathologist may sometimes have difficulty in determining whether one kidney was originally undeveloped, or had been destroyed by disease. Morgagni * knew that the kidney is sometimes so contracted by disease as to make good pathologists think that the organ was originally deficient. In support of this statement he refers to three cases described in the Sepulchretum. In one, the case of a girl, though there was nothing in the place of the kidney, there was a ureter going down to the bladder from the side of the vena cava, to which it seemed to have become agglutinated, after the kidney was consumed.† In another, that of a woman, instead of a right kidney there was seen "a certain kind of involucrum," a membrane which Morgagni supposed often remains behind when the kidney has been destroyed, and which has been described as a "purse" or "bag" by many observers.

The causes of secondary atrophy of the kidney, or, in other words, atrophy due to disease, are numerous, but chronic Bright's disease is by far the commonest. As the result of wasting from Bright's disease, the two kidneys of an adult will seldom weigh together less than one and a half or two ounces, though often less than three ounces. Wasting of the kidney is not an infrequent result of obstruction of the ureter, as will be described under hydro-nephrosis ; and in cases of obstruction of the urine from stricture of the urethra or stone in the bladder, localised wasting of the kidney, the result of previous interstitial nephritis, is by no means uncommon. In these latter cases the surface of the kidney is fissured, and the whole organ more or less shrivelled and atrophic, and bands or areas of fibrous or scar tissue are to be seen in its substance. Embolism, again, leads to a very similar scarred and atrophic condition.

Bradford has made some very interesting experiments in this connection to determine whether obstruction of the ureter could produce atrophy of the kidney. He exposed the ureter

---

* Morgagni, Letter xi., art. 14.

† This is probably the same case that Blasius gives ; the subject was aged twenty-four, and the left kidney was wanting. The left ureter was a fibrous cord without lumen, and a mass of white solid matter as large as two walnuts was attached to the vena cava.

of a dog, ligatured it with silk, and then divided it as close to the bladder as possible. After a variable period (eleven to forty days) a second incision was made in the abdominal wall above the first one and the free end of the ureter found and brought up to the surface of the abdomen. The wound was then sutured so that the extremity of the ureter was left protruding from its lower angle, and it was secured in this position by two horse-hair sutures passing through the ureter and the edges of the skin. The ureter was then incised and the retained urine allowed to escape, the amount being measured if possible. The animal was then kept for periods varying from seven to fifty-one days.

In all cases the ligature of the ureter was followed by disten-sion of the kidney, and a quantity of altered urine, varying from 40 cc. to 70 cc., was let out at the moment of incising the ureter at the second operation. In the great majority of cases the fluid was clear and contained an abundant amount of urea.

After the second operation, which, as Bradford states,* simply consisted in draining the distended and dilated kidney, this organ resumed its normal shape very closely, but became very much smaller than it was previously. It did not become a shrivelled sac as might have been expected, but to the naked eye assumed the form of a normal but very small kidney. The ureter did not take part in this result, but remained thickened and dilated. Microscopical examination showed the atrophy to be due to (1) diminution in size of the renal cells, (2) disappearance of many tubules, and (3) the crowding together of the remaining tubules.

Another interesting point in connection with these valuable experiments was that in no case was ligature of the ureter fol-lowed by suppression of urine, as has been described in human beings after obstruction of the ureter.

The kind of atrophy which, however, is most likely to lead to surgical difficulties and catastrophes is the congenital.

In the secondary forms of atrophic kidney, the clinical history, the age, and the state of the urinary secretions and passages of the patient, are pretty sure to guide one to a correct diagnosis. But in congenital atrophy even the most careful may be betrayed into error. It occurs independently of intrarenal pressure, of

* *Path. Soc. Trans.*, vol. xlix., p. 169.

interstitial nephritis, or of embolism; but is due to some defect
of development, and is often dependent on the rudimentary size
of the renal artery.

The rudimentary kidney varies widely; sometimes it is
foetal in size, and lobulated; sometimes it is represented by a small
group of vesicles, sometimes by a small mass of fibrous or fatty,
or fibro-fatty tissue, sometimes by a mass of white solid substance
attached to the vena cava, and sometimes it is cystic, with patches
of secreting substance on the cyst.   Wilks and Moxon met
with a case in a young man aged twenty-three, who died of
chronic albuminuria, in whom there were but two pyramids
in each kidney, the kidneys themselves being very small, owing
to deficient development.   In a case reported by Sutherland
and Edington * the left kidney was represented by a globular
thin-walled cyst measuring 3·5 cm. in diameter, which was tensely
filled with a clear dark-brown fluid containing urea.   The upper
part of the cyst showed a small amount of solid tissue measuring
roughly 2 cm. by 1 cm.; this was separated at its edge from
the cyst by a definite furrow.   This solid tissue was found
microscopically to consist of distorted renal tubules in an
abundant fibrous stroma.   The cyst occupied the middle line
in front of the sacral promontory, being freely movable and sus-
pended by its vessels.   The left ureter was represented by an
attenuated cord-like structure arising from the furrow at the
upper extremity of the cyst.   There was no lumen in this structure,
and after a short course it passed to the left angle of the trigone,
where there was a slight depression, but no definite orifice.   The
cyst was suspended from the aorta by two vessels.   These arose
from the anterior aspect of the aorta to the right of the middle
line and at a distance of about 1 cm. below the origin of the
inferior mesenteric artery, and they entered the cyst at the
furrow above mentioned.   The right kidney was hypertrophied
and normal in situation.   The specimen was removed from a
child three years of age, who had died of broncho-pneumonia.
Albumen was found in large amount in the urine, but only
for six days before death.

Another interesting case belonging to this class was reported
by Lawrence, in which the atrophied kidney was displaced and

* *Glasgow Medical Journal*, Feb., 1898.

associated with anomalous ureters and vessels.* The kidney was represented by a triangular shaped mass which measured one inch in length, two-fifths of an inch in breadth, and one-quarter of an inch in thickness, and the upper part tapered to a point which corresponded to the point of termination of the renal artery, which ultimately broke into five branches before entering the organ. From the posterior internal surface there issued two pairs of tubes ; of the inner pair one tube arose from near the upper extremity, the other from near the lower angle. The outer pair arose one tube above the other, and much closer together, from near the middle of the surface.

These tubes united to form two tubes of from 2 to $2\frac{1}{2}$ mm. in width, which on being traced downwards were found to pass behind the common iliac vein and artery, and after a course of one inch and a quarter united to form a single tube, measuring 4 mm. in diameter at its upper part. This tube, thick walled, especially at its lower part, the author thought was to be regarded as the pelvis of the ureter ; it passed down in the pelvic cavity towards the base of the bladder, became somewhat narrower at its middle part, but wider again and twisted in its lower third, where it had a width of 6 mm. After a course of $3\frac{1}{4}$ inches it terminated at the level where the vas deferens crosses the ureter, by abruptly contracting to a narrow thin-walled tube measuring not more than $1\frac{1}{2}$ mm. in width. The latter tube the author considered should be regarded as the ureter. There were no other associated abnormalities.

It is fortunately much rarer to find the atrophy present in both kidneys, but it may occasionally occur, and Tennent † records a case of this kind in which the patient, aged 28, died from urœmia. At the post-mortem examination the left kidney measured $2\frac{1}{2}$ inches in length and weighed less than one ounce ; its surface was very irregular ; the pelvis was a double one; the right kidney was $3\frac{1}{2}$ inches in its longest diameter and weighed $2\frac{1}{2}$ ounces. Its pelvis was divided into three divisions, the upper of which was subdivided into two. The surface of this kidney was also very irregular, and the upper part was more atrophied than the lower. There was no obstruction anywhere, and the

* *Journ. of Anat. and Phys.*, 1897, pp. 599.
† *Glasgow Med. Journ.*, vol. xxxi.

condition was looked upon as one of congenital atrophy and malformation. It is, however, not unlike a case of chronic interstitial nephritis.

Northrup * has reported a case of a child five weeks old who died from extraneous causes, in whom after death there was a mere rudiment of the left ureter, which terminated at its upper extremity in a bulbous tip 1 cm. long and 2 mm. broad, which represented the undeveloped kidney. This rudiment was found lying on the left common iliac artery at the level of the last lumbar vertebra; no vessels of any kind could be traced into it. Other defective and peculiar conditions noticed by Ebstein and Watson have been mentioned above.

It has been stated above that the ureter of the congenitally atrophic kidney varies much. Sometimes it is a fibrous cord without a lumen (Blasius); sometimes it is twisted on itself, ending in a reduplication, and thus having no communication with the bladder; sometimes it is short and narrow, and has an opening into the bladder no larger than a pin-hole; sometimes it is of normal size and appearance, and passes down from the atrophied kidney to open quite naturally into the bladder.

All kinds of variations as regards the **renal vessels** of the atrophic organ have been described.

The atrophic kidney may be also misplaced, as in Dr. Ewart's case.‡

It is more than probable that congenital atrophy or deficiency of one kidney predisposes to chronic renal disease, and to albuminuria in early and young life. Eustachius found in the body of Bonifacio Corneo one kidney the size of a chestnut, and sound; but the other large and in a state of suppuration from calculous pyelo-nephritis. He thought that the stimulus of disease had drawn blood from the healthy to the calculous kidney, and hence the shrinking of the healthy organ. But it is much more probable that the small healthy kidney was atrophic from birth, and that its vessels were originally small in proportion. The case is of importance, because it shows with how small an amount of functionally active renal tissue life can be sustained.

The frequency, or rather infrequency, of congenital atrophy

* *Trans. of New York Path. Soc.*, 1889.
‡ See *Trans. of Lond. Path. Soc.*, vol. xxxi., p. 187.

of one kidney, *the atrophied organ being for all practical purposes quite wanting*, may be judged of from the fact that there are only six such examples recorded in the whole fifty volumes of the *Transactions* of the Pathological Society ; and from the fact that 15,904 post-mortem examinations at St. Bartholomew's, Guy's, the Middlesex, and the Hospital for Sick Children, Great Ormond Street, yielded only three cases of extreme atrophy or extreme want of development of one kidney.

The figures of the Middlesex and Great Ormond Street Hospitals show that *a disproportion in size* of the two kidneys from some amount of, but not extreme, congenital atrophy of one of them, occurred twelve times in 7,472 subjects. In most of these cases the opposite kidney was much enlarged, so that there was quite an average normal amount of renal tissue, though contained unequally in the two organs. In one case in which this was not so (a child aged two and a half years), one kidney weighed two ounces and the other three-quarters of an ounce.

In addition to these, there were two cases of atrophy from impervious ureters, but whether they were of congenital origin is not quite certain.

General remarks on unsymmetrical, solitary, and imperfectly developed or congenitally atrophied kidneys.

Symptoms and diagnosis of single kidney.—There are no symptoms which can be attributed to unsymmetrical, solitary, or imperfectly developed kidneys. The cystoscope and ureteral catheter might aid in diagnosing the absence of one kidney. If the renal substance of the existing organ is healthy the excretion of urine goes on naturally, and the health and physique of the person may be perfect. An " unsymmetrical," or any of the other varieties of single kidney, is consistent with healthy life.

Many persons with an unsymmetrical kidney have lived to advanced life, and died of disease unconnected with their kidney. In solitary kidneys the danger to life from possessing only a single organ is not nearly so great, because there are, as a rule, two independent pelves and ureters, and therefore the risks of plugging of one ureter are much the same as when the kidneys are distinct and in their proper positions. This is even more true of horse-shoe kidneys than of the more completely fused organs.

Dr. Beadle's (of Glasgow) case of a male with absence of left kidney, left ureter, and left suprarenal capsule lived to forty-five years of age. And this may be taken as a type of "unsymmetrical" kidney, for the majority have been met with in individuals of middle age, although, as previously mentioned, many have been found in persons of much more advanced life and
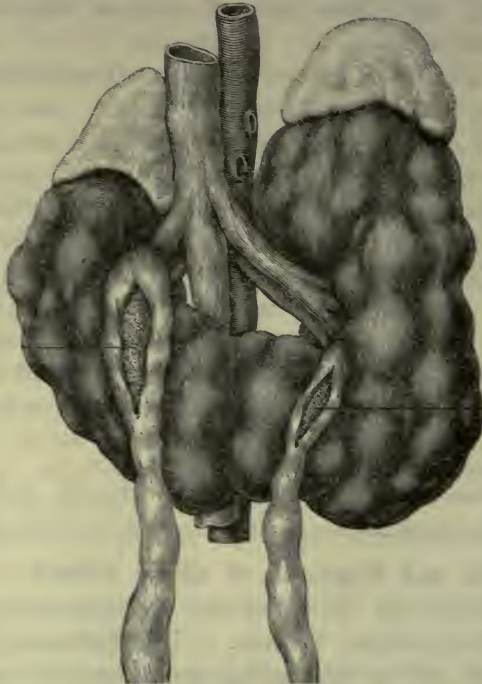
Fig. 18.—Horse-shoe Kidney with Calculus in each Ureter. (Middlesex Hospital Museum.)

even after the eightieth year. The complications which may involve a single kidney, and which indeed seem prone to arise, make life much more precarious on the score of renal diseases.

Albuminuria.—Probably, as has been above stated, there is a tendency to chronic albuminuria in early or young life in persons with one kidney atrophied.

Tendency to formation of renal calculi.—When only one kidney exists, and that an "unsymmetrical" organ, there would seem to be a considerable disposition to renal calculus. Of the twelve cases of unsymmetrical kidney collected by Mosler, death was due more or less directly to calculus in the pelvis

or ureter in nine of them. In the other three, cancer of the bladder and rectum involving the ureter, nephritis, and the consequences of obstruction due to severe congenital phimosis, were respectively the causes of death. In the case of cancer (Tulpius), a calculus had been passed per rectum in early life, and there was an opening from the ureter into the rectum through which part of the urine escaped.

In Rayer's list, six cases of unsymmetrical kidney were affected with calculus, but three of these are the same as Mosler's. Rayer also gives one case of atrophic and one of fused kidney affected
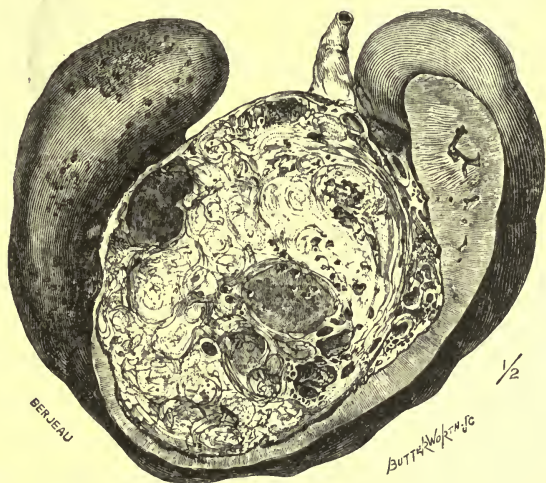
Fig. 18A.—Horse-shoe Kidney with a Tubular Carcinoma four inches in its chief diameter. (Hunterian Museum, No. 3584K.)

with calculus. In the atrophic case the atrophy was caused by a calculus ten drachms in weight, and the kidney was suppurating and entirely destroyed. Mr. T. Wilmott * published a case of a patient with only one kidney, in whom there was a sacculated nephritic abscess due to impaction of a calculus the size of an almond in the commencement of the only ureter. There was no kidney on the right side. The left kidney weighed twenty-eight ounces. The patient was a woman aged thirty. Manby † recorded a case of cancer of an unsymmetrical kidney in a painter, aged forty-eight years. Gould met with a horse-shoe kidney, in a woman aged sixty, in which was a tubular carcinoma

* *Brit. Med. Journ.*, Nov. 24, 1883, p. 1014.
† *Lancet*, April 11, 1885.

(*see* Fig. 18 A). The illustration (Fig. 18) shows a very interesting condition of things in which double calculous nephritis occurred in a horse-shoe kidney, in consequence of the impaction of a calculus in each ureter.   The patient was admitted into the Middlesex Hospital,* and died three days after with symptoms of uræmic poisoning.

Orifice of the left
ureter.
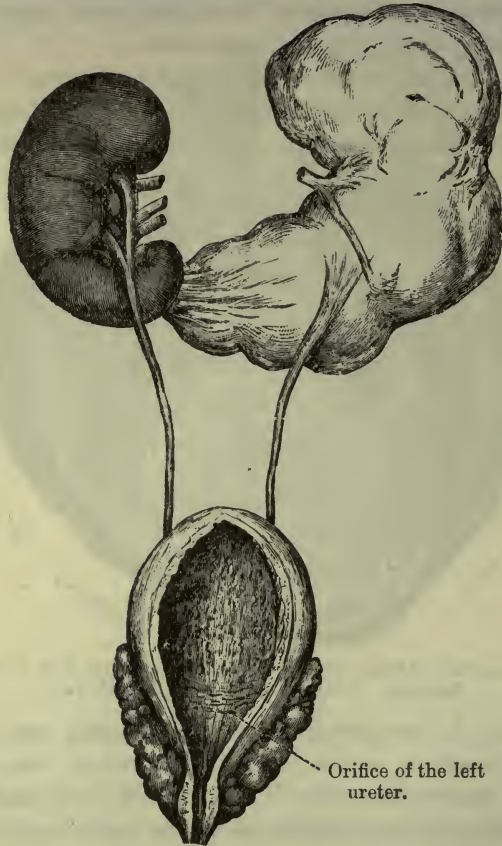
Fig. 19.—Horse-shoe Kidney, with Ureters and Bladder. The left half of the renal mass was converted into a large thin-walled pyo-nephrotic cyst.   (Middlesex Hospital Museum.)

Nephrectasis.—In other cases of unsymmetrical kidney there has been hydro- or pyo-nephrosis due to some cause undetected ; in one or two instances the quantity of urine excreted was very small, the bladder was small, and the patient subsequently died dropsical.

* *Med. Reg.*, 892 : *P. M. Reg.* 170 (1894).

Sometimes one-half of a horse-shoe organ is completely destroyed, the other half being quite uninvolved. This is seen well in the accompanying figure (Fig. 19), taken from a specimen added to the Middlesex Hospital Museum by Mr. Andrew Clark; one-half of the horse-shoe was converted into a cyst filled with pus; the cause of the disease was not ascertained. The patient had passed pus with his urine during life. Sutherland and Edington [*] have described and illustrated a horse-shoe kidney, taken from a male child, one-half of which was pyo-nephrotic and had given rise to an abscess in the perinephric tissue; in addition there was an abscess in the left half of the isthmus. The right half of the organ was normal. Somewhat similar but less well-marked cases are recorded.

In a case, of which I have notes, one-half of the horse-shoe kidney was dilated and suppurating, and the cellular tissue around it was inflamed.

Chronic nephritis.—In the case of a young man, aged twenty-seven, with horse-shoe kidney, reported by Dr. Gibb,[†] the entire organ was in a state of Bright's disease.

Abnormal pressure - effects of horse-shoe kidney.—Piccol-hominus [‡] and Azzaritti have hinted that ill consequences some-times arise from the pressure of the isthmus of a horse-shoe kidney on the aorta and vena cava; the latter, in this way, accounted for an aneurysm in the first part of the abdominal aorta (*i.e.* between the pillars of the diaphragm), which eroded the vertebræ and subsequently ruptured into the left pleural cavity. Generally, however, the isthmus is very thin, or even fibrous, and does no harm by its pressure on the large vessels. Nor is there, so far as I know, any reason for attributing to it any disturbance of the sympathetic system.

Abdominal tumour caused by single kidney.—The size of the single kidney is, in some instances, very great. In Dr. Kelly's [§] case of complete fusion the renal mass weighed ninety-three ounces. No tumour however was detected during life.

Morgagni refers to a case in which one kidney, as the result of atrophy of the other, was ten times larger than natural; and to another case in which a kidney weighed thirty-five pounds;

[*] *Glasgow Medical Journal*, February, 1898.
[†] *Path. Soc. Trans.*, vol. xiii., p. 132.
[‡] Morgagni, Letter xlviii., art. 16; vol. iii., p. 719.
[§] *Path. Soc. Trans.* vol. xix., p. 274.

and again to a third, noticed also by Fantonus, in which the single kidney was more than twice this (thirty-five pounds) weight.

Other cases are referred to as of " surprising bulk and magnitude " (Fernelius) ; or as " of an almost incredible magnitude and breadth " (Boreus). In these cases, however, it is probable that disease was superadded to hypertrophy.

It might easily happen that a horse-shoe kidney, or two kidneys more or less completely fused, and situated in the median line of the abdomen or in some part of the pelvis, would give rise to the opinion that a morbid growth existed. This would be more especially apt to occur if the abnormal kidney mass could be readily felt by palpation of the abdomen, or by examination *per rectum* or *per vaginam ;* and still more likely if, in addition, the person was an invalid, or suffered from pains in the abdomen or pelvis, due to some other cause ; or if hydronephrosis or pyo-nephrosis affected the organ thus misplaced.

In the days before abdominal surgery was much practised, as well as since ovariotomy has been established as one of the most successful of operations, renal tumours had been recognised amongst the " causes of false pregnancy." From the writings of those who had preceded them, even the earliest ovariotomists might have been, and doubtless some of them were, cognisant of the possibility of such errors in diagnosis. But by the mistakes of ovariotomists, nephrectomy was performed before removal of the kidney was admitted to be, or had been advocated as being, a scientific operation.

In the Sepulchretum, amongst the conditions which resemble pregnancy is mentioned prominence of the belly from the size and position of a solitary kidney.

Rhodius, in 1661, recorded a case of solitary kidney which occupied the middle line, and was of such a size that the woman was thought to be pregnant.*

Vesalius wrote † that sometimes in those who " have the belly exceedingly prominent, and the order of the ribs vitiated, he had seen a solitary kidney, and that a very large one, placed upon the vena cava and the large artery." Eustachius ‡ refers

* Rayer's " Maladies des Reins."
† " De Corpore Humani fabricâ," lib. v., cap. 10.
‡ " De Renibus," cap. 10.

hesitatingly to the same prominence of the abdomen, but does not confirm it by the account he gives of a solitary kidney lying on the middle of the spine. Morgagni could not doubt that when a bulky solitary kidney rests on the spinal column the belly would be prominent; he quotes the case of a woman who was supposed at first to be pregnant, but in whom the abdominal enlargement was proved on dissection to be due to a solitary kidney. He adds that Spigelius might have suspected pregnancy, had the subject been a female, in a case of solitary kidney very similar to that of the woman just mentioned.

Morgagni adds, however, that the suspicion of pregnancy in such cases can only occur to the individual who is about to make the post-mortem inspection, because during the life of the woman the clinical history and duration of the tumour would prevent one from going astray in one's diagnosis. The solitary, centrally placed kidney will probably have been of congenital origin; the pregnancy of but a few months' duration.

When, however, one or other of the kidneys has grown large from disease, we must quite recognise the possibility of committing an error in diagnosis.

It is, indeed, far less probable that a single kidney, even if of large size, when situated over the vertebral column, will be mistaken for pregnancy or ovarian cyst or uterine myoma, than that a cystic or solid tumour of the kidney will be thus regarded. The important point in either case, however, is for the surgeon who contemplates operative treatment to ascertain whether the kidney is single or not. The cystoscope and the ureteral catheter may afford information.

In some thin subjects the kidney can be made out in the loin by manipulation and palpation. But this is not always possible.

Malformations and deformities.—There is one feature which has been found associated sufficiently often with misplaced, movable, unsymmetrical, horse-shoe, and other forms of solitary kidney, to make it worthy of special attention. I refer to malformations and abnormal developments of other parts and organs of the body as well as of the urinary organs. While treating of misplaced kidneys, I mentioned that the large intestine is comparatively frequently transposed or abnormally disposed, but many other and more striking and noticeable deformities have been also observed.

From a list of such cases which I have met with in my reading or otherwise it is evident that defects of the generative organs are very prone to be associated with abnormalities of the kidneys.

The practical rule for surgeons to bear in mind is, therefore, that if nephrectomy is contemplated on a person who has any congenital malformation or deformity, and more especially if the malformation or deformity is of the genito-urinary system, very particular care should be taken to ascertain whether there are two kidneys or only one.

3.—ABNORMALITIES OF NUMBER (*continued*).

D. ABSENCE OF BOTH KIDNEYS.

The absence of both kidneys has many times been observed by Rayer and others in the fœtus and in children still-born at full time. Beclard * states that the kidneys are often wanting in acephalous monsters, but that one kidney at least is always present when a certain length of the vertebral column is developed. M. Moulon † of Trieste has recorded the case of a young girl, fourteen years old, who died of chronic gastro-enteritis, and in whom neither kidneys nor ureters were found. The umbilicus was situated where ordinarily the " mons veneris " is. The symphysis pubis was replaced by a wide gap, covered only by the skin. The bladder was wanting. The urachus, very large and long, was lost gradually in the integuments. The umbilical vein greatly surpassed that of an adult. The uterus, ovaries, and Fallopian tubes were perfect. The external genitals were very defective, and the anus, which was inordinately large, opened where the vaginal orifice should have been. From birth this girl had been subjected to a continual discharge of a liquid very like urine from the umbilicus. The fluid which flowed thence had such a penetrating odour that it was impossible for her to change her linen often enough to be free of smell. M. Moulon concluded that the blood in this case gave up those constituents which go to form the urine, to the liver ; and that they were conveyed by the umbilical vein to the umbilicus and

* Beclard, " Mém. sur les Acéphales," *Bullet. de la Faculté de Méd. de Paris,* tome vi., p. 497.

† *Archives Générales de Médecine,* tome xvii., p. 424.

there excreted. The liver was gangrenous, as were the intestines in spots throughout their extent. The pancreas was converted into a sac of pus, and the great omentum was in part destroyed.

Rayer quotes M. Moulon's case, but with great mistrust; he considers that the real condition was atrophy of the bladder, and that the kidneys were congenitally misplaced, but overlooked because not properly searched for at the post-mortem examination. This opinion does not seem to be borne out by the description of the post-mortem examination, for from the report it would appear that all the abdominal and pelvic contents were thoroughly investigated.

If M. Moulon's case is trustworthy, it enables us to understand certain published cases of congenital hydro-nephrosis, and others of anuria lasting over many months.

Vieusseux of Geneva speaks of a case of prolonged suppression of urine in a young girl of eleven years of age. The suppression lasted seventeen months and then the excretion of urine was re-established.

Dr. Polk's † case has proved that a young person of nineteen years of age can live for nearly twelve days after being suddenly deprived of her only kidney ; and that during the last days of her life a small quantity of fluid containing urea was discharged from the bladder. This fluid, it is true, might have been a small quantity of urine which was left in the ureter after the nephrectomy, and which only slowly reached the cavity of the bladder. But vomiting and purging are frequent symptoms during suppression, and by these means some of the constituents of the urine are removed from the blood, though at length exhaustion supervenes, and death, preceded by coma, occurs. Such cases, while they show how difficult it is for the excretion of urea and uric acid to be efficiently carried on by tissues and organs suddenly called upon to perform such unaccustomed functions, do not disprove, but on the contrary help somewhat to make us give credence to the idea that when both the kidneys are congenitally deficient life may be rendered possible for a

* *Journal Médical ;* Corvisart, Leroux, et Boyer, tome vii. ; Vendémiaire, An. XII. (October, 1803).

† *New York Medical Journal*, Feb. 17, 1883.

time by the liver and intestines assuming the renal functions. Vieusseux's case shows that life may continue for many months together, in spite of complete cessation of all secretion from the kidney, in a young person whose renal organs had previously performed and subsequently resumed their full functions. Numerous cases of fœtuses without kidneys, but in many if not all other particulars fully developed, show that the absence of renal organs is not incompatible with intra-uterine development and existence up to full time.

Mayer of Bonn published * a case of a still-born male infant of full term in which the lungs, heart, liver, spleen, and greater part of the intestines were normally developed, and the suprarenal capsules were about twice their normal size, though the kidneys, ureters and urinary bladder were completely wanting. The gall-bladder, external genitals, sigmoid flexure, rectum, and anus were also absent. The spinal cord terminated in a club-shaped extremity opposite the second dorsal vertebra, though the vertebral column was continued as far as the fourth sacral vertebra. The sciatic, obturator, and crural nerves were almost of normal size; but the abdominal sympathetic was less developed than usual around and about the intestinal arteries. The abdominal aorta was nearly normal, but gave off no renal branches. The testis and epididymis on each side were small, and the vasa deferentia terminated in cellular tissue in their serous tunic. There were other minor vices of conformation besides the above. As Mayer remarked, it appears from this case that the most important functions of animal and organic life can go on, at least during intra-uterine life, without the assistance of the urinary organs. Mayer also raised the question whether the development of the spinal cord is not a necessary condition for the development of the urinary organs, and he refers to the Mémoire of Tiedmann, in which this theory is discussed.

Rayer, who cites Mayer's carefully reported case very fully, gives references to several analogous cases; as well as to cases of double monsters (la duplicité monstrueuse par inclusion) in which the kidneys were wanting.

* Zeitschrift für Physiologie; and Journal des Progrès, tome iv., p. 281 (1827).

Chaussier * also exhibited the trunk of a fœtus in which there were neither kidneys, uterus, nor urinary bladder.

I will again remark that it is interesting and important to the surgeon to notice how frequently abnormalities of the external or internal genital organs, or of both, co-exist with the absence of one or both kidneys.

E. SUPERNUMERARY KIDNEY.

Supernumerary kidneys are extremely rare and are usually found accidentally after death, as they do not give rise to any symptoms which indicate their presence during life.

An example of this condition is recorded in the report of the Supervising Surgeon General of the Marine Hospital Service of the United States, 1885 (pp. 148–150).

The subject was a man, aged thirty-nine : a third miniature kidney was found in the hilum of the left kidney and attached by a small duct (its ureter) to the ureter of the left kidney.

This supernumerary organ was 2 cm. in length and 1·2 cm. in breadth, while its greatest thickness was 1 cm. It was invested by a capsule, and the inferior extremity of the organ was slightly thicker and more rounded than the superior.

On section the portion corresponding to the cortex of a true kidney was thin and darker in colour than the rest of the cut surface, which was pale and granular in appearance. There was no clear definition of pyramids, but at the hilum there was a distinct space, from the margin of which pyramidal bundles of tubes radiated into the mass of the organ. This space or pelvis communicated freely with the duct that appeared to represent the ureter, which was 10 cm. long and pervious for about 2·5 cm. from the pelvis. A small artery and vein accompanied this tube, and both of these were pervious.

Microscopical examination showed it to possess a structure strongly resembling that of a kidney, in the tubular arrangement of epithelial cells, the existence of an intertubular stroma and of interspaces and Malpighian tuft-like bodies, but there was no structural evidence that it had ever undertaken physiological secretion.

* *Bull. de la Faculté de Méd. de Paris*, p. 35 (1810).

Newman, again, mentions a case in which the supernumerary gland was represented by a small pear-shaped body lying close to the upper margin of the left kidney. It was supplied by a branch of the renal artery, and had a distinct ureter, which passed into the left ureter half an inch below the pelvis of the left kidney.

An interesting example of a third kidney which was also movable is recorded by Watson Cheyne.* The supernumerary gland was in this case discovered during laparotomy; it was well developed and situated on the right side of the lower part of the spinal column just at the brim of the pelvis. It had its own ureter and blood supply and was from three to four inches distant from the right kidney, which could be felt in the right loin and was apparently of normal size. The left kidney was also felt, and seemed rather smaller than the right. The third kidney in this case was quite movable.

* *Lancet*, 1899, vol i., p. 215.

CHAPTER III.

CLINICAL EXAMINATION OF THE KIDNEY.

HAVING described the anatomical relations of the kidney, its malformations and abnormalities, it will be well, before giving an account of the various affections of the organ for which surgical treatment is required, to draw attention to the methods of examining the kidney in the consulting room or at the bedside.

In every case in which the kidney is supposed to be affected, answers have to be sought to three questions :

First, Is the kidney really affected ?

Second, Is one only, or are both kidneys, involved ?

Third, If only one, which kidney is at fault ?

In the following pages the difficulty in giving satisfactory answers to these questions will again and again be pointed out, more especially in reference to new growths, renal calculus, and tuberculosis. A satisfactory reply, in many cases, can only be obtained after an exploratory operation or ureteral catheterisation. These methods of examination are fully described and discussed later on. What is aimed at here is to give the reader some directions which may assist him to properly investigate a case without or before having recourse to either the cystoscope and the ureteral catheter, or the knife.

There are three steps in making a bedside examination which ought to be invariably followed, namely (1) inspection, (2) palpation, (3) percussion.

1. **Inspection.**—The front of the abdomen and the lumbar regions should be uncovered to the skin, and should then be carefully inspected : first, as the patient lies on his back, next, whilst he is on his abdomen, then on one side and on the other, and finally—if thought desirable—when in the sitting or the erect posture.

If a kidney is normal in size, in fixity, and situation, no evidence of its existence is furnished by inspection. If, on the other hand, the kidney is " floating," or is enlarged by calculus or tubercle, or is in a state of " nephrectasis "—that is, of distension

by urine, pus, or blood—its presence is often revealed to the eye
of an experienced observer. A "floating" kidney often slightly
presents against the anterior abdominal wall—between a vertical line
drawn through the anterior axillary border and another through
the nipple—as a smooth convex body; and posteriorly, in the ilio-
costal space on the same side, the parietes have a forward "dip" or
depression.   A flaccid, pendulous abdomen, and what is called by
the French *ventre trilobé*, is often associated with movable kidney.
An enlarged kidney, whether the enlargement is due to nephrectasis
or to a new growth, may efface the natural hollow of the loin,
or even cause some actual fulness there, but rarely projects or
protrudes backwards to any distinct degree.   If of large size, it
will bulge the abdominal wall, laterally, to a very appreciable
extent; but its most decided tendency is to expand forwards.

2. **Palpation.**—By palpation we learn the position, degree
of mobility, the outline or form, the volume, consistence, the
irregularities of surface, and the degree of sensitiveness or tender-
ness of the kidney.   It must be borne in mind, however, that
many normal kidneys are quite beyond the reach of palpation;
that they cannot be distinguished by the most careful manipula-
tion; and are not brought within the grasp of the examining
fingers, even on the deepest inspiration.   The kidney in some
persons may even be very much enlarged without being amenable
to palpation, and this is especially the case if the enlargement or
distension takes place principally or entirely in the upper half
of the organ: the expansion in that case occurs in an upward
direction and the enlarging kidney expands beneath the diaphragm,
increasing at the expense of the thoracic rather than of the
abdominal organs.

To properly palpate the kidney, the patient should be lying
on his back, with his shoulders slightly raised upon a firm pillow,
the lumbar spine resting quite flat upon the sofa or mattress,
and the lower limbs very slightly flexed.   He should be encouraged
to breathe naturally and easily and keep his thoughts as much
as possible from the examination. There is a tendency—very
much greater with some patients than with others—to arch
the lumbar and lower dorsal spine as soon as the surgeon
commences his examination.   This should be avoided if possible,
because, when the vertebral column is curved forward, there is

a tendency for the kidney, even when of natural size, to become
unduly prominent, and to advance towards the abdominal parietes.
This is more especially the case in women, and when the kidney
is at all movable (*see* an observation by Sir W. Jenner, referred
to on p. 532).

Another tendency with many patients is to contract the
muscles of the abdominal parietes as soon as the surgeon places
his hand upon the body, thereby hardening the abdominal wall,
which thus presents an effective barrier to palpation.

The patient, being in the required position, should be close
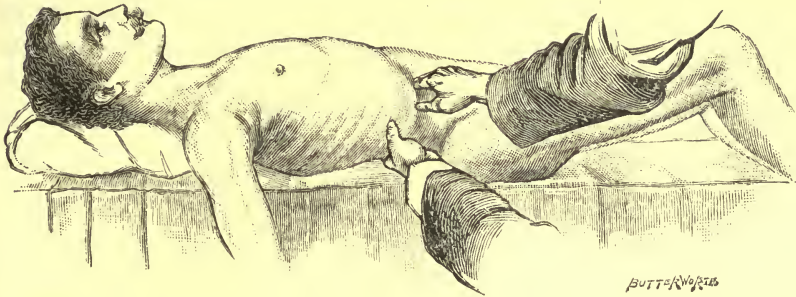
Fig. 20.—Position of the Patient and of the Surgeon's hands when palpating
the Kidney.

to the edge of the bed or couch on the same side as the kidney
which is to be first examined, and should afterwards change
to the opposite side of the bed for the examination of the other
kidney.   The surgeon then places the fingers of one hand on
the loin over and also just below the last rib, and the fingers of
the other hand flat upon the front of the abdomen just below
the costal margin (Fig. 20).   He should be on the same side of
the patient as the kidney he is about to examine, and should
be sitting or kneeling at the bedside, so as to have his lower-
most forearm as nearly as possible level with the patient's body.
When examining the right kidney, the left hand should be on the
loin, the right in front; when examining the left kidney the
right hand should be on the loin, and the left on the front of
the abdomen.   With the hand on the loin the lumbar parietes
should be gently but firmly pressed forwards, and sustained so ;
then the fingers of the hand in front should gently and steadily

depress the anterior abdominal walls upwards, backwards and
outwards. The kidney, if enlarged or displaced at all, will now
be felt between the two hands, and even if not enlarged, the
lower third or half of the organ will, in some persons, be
detected by the fingers during natural respiration.

Should this not be the case, the patient should be directed
to take a long, deep inspiration, and suddenly, but without mus-
cular effort, to allow the air to escape from his lungs : in other
words, he should make a long-drawn " sigh." The hand behind
still maintains forward pressure on the loin, and the hand in
front quickly follows the receding abdominal wall as it becomes
relaxed in the expiratory movement. Thus the kidney, which
otherwise cannot normally be felt, can often be seized between
the fingers of the two hands before it has time to regain its
normal position. This method becomes even more efficacious if
the patient takes a second and a third similar " sigh " whilst
the surgeon maintains and increases the deep pressure he has
made after the first and second.

With one hand placed on the front of the abdomen, nothing
satisfactory can be learned, except when (1) there happens to
be a " floating " kidney which rides forwards against the anterior
abdominal wall ; or (2) the kidney is much displaced to-
wards or into the iliac fossa, or on to the front of the spine ;
or (3) the kidney is much enlarged. Palpation with a single
hand, placed on the loin, affords, as a rule, no information
whatever.

When the kidney can be seized between the fingers of the
two hands placed as above directed, then by jerking forwards
the fingers of the hand behind, the kidney can be felt to
come with an impact against the fingers of the hand in front ;
and *vice versa*, if the fingers on the front quickly press the organ
backwards, it comes with a slight jerk against the fingers behind.
Bright, years ago, observed this antero-posterior movement as
being a feature of some renal enlargements. Guyon has dignified
it by a special name, calling it renal *ballottement*. This *ballotte-
ment* is not always present : kidneys which have long been the
seat of irritation—as in calculous and tuberculous disease, and in
many instances of nephrectasis with suppuration—excite chronic
changes which lead to adhesions sufficiently firm to prevent any

movement of the kidney, either within, or together with, its peri-
nephric investment.

Palpation is sometimes assisted by raising the patient's shoul-
ders so that he assume the semi-recumbent attitude.

In testing for mobility of the kidney it is sometimes advan-
tageous to place the patient in the knee-elbow posture, or even
in the upright position.

As a rule, however, I find it best to get the patient to roll
over on to the opposite side and then to employ bimanual
palpation whilst he takes a long-drawn breath, as described on
the previous page.

A movable kidney, which persistently declines to leave its
proper place as long as the dorsal posture is maintained, will
very frequently fall at once towards the front of the vertebral
column below the costal margin as soon as the lateral position
is assumed and a deep inspiration is taken.

The bimanual method of Glénard * consists in placing one
hand on the eleventh costal arc, with the thumb in front and
the middle finger behind ; then crowding back the abdominal
walls with the other hand placed on the umbilical region ; then
by compressing the intervening structures between the fingers of
the two hands, the kidney, as it descends on the patient taking
a deep inspiration, will be detected by the thumb of the hand
which is embracing the costal arc. The surgeon sits facing the
patient, either on the same side as, or opposite to, the kidney
which he is about to examine.

Chloroform narcosis greatly assists renal palpation, more
especially in persons with strong reflex muscular contractions ;
in those who have very rigid abdominal walls, or whose muscles
instantly recoil on the slightest pressure ; and also in persons
with a large amount of adipose tissue.

With kidneys which are not movable, which are but slightly
if at all enlarged, or the enlargement of which affects only the
upper pole of the kidney, chloroform does not render much assist-
ance. Moreover, under chloroform, the renal sensibility is, of
course, lost, and no information is afforded as to whether tender-
ness is present or not.

Pressure on a normal kidney, though it causes the peculiar

* Glénard : "Les Ptoses Viscérales," p. 376 *et seq.*

feeling which is spoken of as renal sensibility, does not excite
pain : but a sudden sharp pressure or compression between the
fingers will generally provoke pain if the kidney is inflamed or is
the seat of calculus.

By palpation we ascertain not only the size, position, mobility,
and sensitiveness of the organ, but we ascertain also the character
and the outline of a swelling.   The kidney is rounded off on
every aspect, and though the inner border is often lost against
the spinal column, yet, when the notch at the hilum can be
made out, the margins of the notch, like those of the rest of
the organ, have a rounded-off character.   The absence of any
sharp or bevelled edges distinguishes renal from hepatic and
splenic enlargements.

3. **Percussion.**—Percussion is practically of no use for the
purpose of delimitation of the normal kidney.   It is only of
importance in the diagnosis of enlargements of the kidney
from enlargements of other organs within the abdomen.

Anteriorly, there is resonance over a renal enlargement,
owing to the large intestine being in front of the kidney.

Bowel is never thus placed in front of a splenic enlargement,
and only rarely in front of one of hepatic origin.   As a renal
enlargement expands, the large bowel becomes displaced to the
side of the tumour; the ascending colon to the median side of
the right kidney, the descending colon to the outer side of the
left kidney.   Coils of small intestine may give a resonant note
over the front of a swelling either of the right or the left kidney,
if the enlargement is but moderate and is insufficient to bring
the kidney into direct contact with the anterior abdominal walls.

Posteriorly, there is no line of resonance between the kidney
and the vertebral column, though there is normally a wide reso-
nant area between the vertebral column and the spleen or a
splenic tumour.   There is no space between the kidney and the
spinal groove into which the finger tips can be depressed, as
there is between the spleen and the spinal column.

Other means of examination.—*The X rays* have now been
repeatedly employed in cases of suspected calculus ; and in some
cases with admirable effect.   But the results are most unre-
liable ; shadows having been found when no calculus was present,
and no shadow obtained when a calculus existed ; and were the

negative results allowed to influence surgical treatment, many patients who are now cured by operation would be left to linger on in suffering till they die (see chapter on Renal Calculus, Vol. II., p. 43).

The phonendoscope, in the hands of its inventor (Bianchi), appears to have given information as to the area of kidney dulness, and if reliable it would help in discovering the sub-diaphragmatic expansion in cases of enlargement of the upper pole of the kidney.

It has not, however, found favour as a means to diagnosis in the London hospitals so far as I can ascertain.

The freezing test of the functionating power of the kidney has been much extolled. It consists in the fact that the normal blood has a freezing point 0·36 C. below that of distilled water, and a diminution of the freezing point down to 0·50 C. or lower indicates that the kidneys are not functionating properly.

The freezing point of the urine is less reliable, but when below 0·9 C. renal insufficiency is indicated.

Catheterisation of the ureter.—The objects of this procedure are threefold, namely (1) to collect separately, for separate examination, the urine from the two kidneys ; (2) to test the patency of the ureter and renal pelvis ; (3) to treat certain cases of nephrectasis, or of stricture of the ureter.

Cystoscopic inspection of the ureteral orifices.—By this means indications are sometimes furnished of the condition of the kidneys : (1) by the character of the urine escaping from the ureter ; (2) by the state of the ureteral orifice itself, and of the mucous membrane of the bladder immediately surrounding the orifice.

Catheterisation of the ureter and cystoscopic inspection of the ureteral orifices will be considered further on (Vol. II., p. 301). These methods in some cases give clear answers to the questions : " Is urine being excreted by two kidneys or only by one ? " " Is one kidney only, or are both kidneys, involved ? " and " If only one is diseased, which kidney is at fault ? "

When the urine collected from a ureter is chemically or bacteriologically abnormal we have, of course, proof of the kidney or the ureter from which it comes being diseased. But in view of the fact that a kidney very defective in structure may yield a certain amount of normal urine, we must not infer the soundness of an organ from the absence of any abnormality in the urine derived

from it.   It was to overcome this source of error that experiments were made with coloured substances injected into the subcutaneous tissue, with the object of watching their progress through the kidneys, as indicated by their appearance in the urine.

The methylene blue test.—Many substances have been used to test the permeability or excretory capacity of the kidneys, but most of them require that the urine should be submitted to a chemical analysis which, in some instances, is of a prolonged and delicate character.   To obviate this necessity, Achard and Castaigne* employed the methylene blue test.   The permeability of the kidney to this substance seems, from experiments and clinical observations, to be in very close relation to the capacity of the kidney to eliminate urine of normal characters.

The normal appearance in the urine of the blue and of chromogen affords a very strong presumption in favour of the integrity of one, at least, of the two kidneys ; but the cystoscope or the ureteral catheter is needed to determine if either of them, and if so which, is at fault.

The test has been employed in many different diseases, but in particular in persons with renal disease, and it has been observed repeatedly that the commencement of the appearance of the blue in the urine is delayed in nephritis and in the various forms of renal obstruction.

The method of applying the test is as follows :   (1) Empty the bladder ;   (2) inject 1 cm. of a 5 p.c. sterilised solution of methylene blue beneath the skin of the buttock or thigh ;   (3) get the patient to pass water an hour after the injection, and every hour afterwards as long as the urine is at all coloured blue.

The blue ought to appear in the urine within an hour, and should increase in amount for several hours, when it should diminish, and disappear entirely after thirty-six to forty-eight hours.

Chromogen, which is detected by adding a few drops of acetic acid to boiling urine, is eliminated normally with the blue, but in smaller quantity

According to the kind and degree of pathological changes in

---

* "Diagnostic de la Perméabilité rénale," *Soc. Méd. des Hôp.*, 30 Avril et 18 Juin, 1897 ; also *Revue Générale Gaz. des Hôp.*, 11 Juin. 1898 No. 66. See also *Ann. des Mal. des Organ. Génito-urinaires*, 1899.

the kidney there will be a greater or less delay in the commence-
ment of the elimination of the blue ; the period during which
it is being eliminated will be more or less prolonged ; or the
blue may fail entirely to appear in the urine, chromogen alone
being present, and that only in very small amount.

A permeable or healthy kidney allows the blue to pass in
great quantity ; an impermeable, defective, or diseased kidney
allows of its passing only in small quantity, or not at all.   This
is the one proposition about which there is complete accord.

Hepatic affections have a disturbing effect upon the renal
functions, especially in states of nervous polyuria and compensatory
hypertrophy; and various other circumstances and conditions seem
to be able to influence the length of time after the injection
before the blue appears, as well as the duration of the period
during which it continues to appear.

Nor does there seem to be absolute certainty, as yet, as to
the conditions affecting the presence of chromogen.

The phloridzin test.—It has been known for many years that
phloridzin produces glycosuria.*   Recently Dr. Pavy † showed that
when it was injected into the renal artery of a dog it produced
the immediate appearance of a large quantity of sugar in the urine
from the kidney of the same side, and a little later in that from
the opposite kidney.

Drs. Casper and Richter ‡ show that the artificial glycosuria
resulting from the administration of phloridzin is modified in a
decided manner by the functional activity of the kidney being
diminished on one or both sides, according to the distribution and
extent of the disease.

The efficiency of renal secretion is deduced from the rapidity
with which the sugar appears.   Normally its appearance is within
half an hour or an hour after the subcutaneous injection of the
drug. Catheterisation of the ureter is requisite to determine whether
one or both kidneys are concerned in eliminating the sugar.

Note.—Reference may be made to the preliminary chapter on Tumours
(Vol. I.; p. 529), and to the account of the Operative Treatment of
Renal Calculus (Vol. II., p. 131 *et seq.*), respectively, for Remarks on the
Diagnosis of Renal Enlargements, and for the Method of Exploring the
Kidney by Lumbar Incision.
* *Dublin Med. Journ.*, 1862, p. 39.   † Path. Soc. Lond., Nov. 6, 1900.
‡ *Berl. klin. Wchns.*, July 16, 1900, p. 643.

CHAPTER IV.

MOVABLE AND FLOATING KIDNEY.

THE first recognition of abnormal mobility of the kidney dates back into the far past, but more attention than ever before has been given to it since Martin of Berlin, in 1878, performed the first nephrectomy for movable kidney, and Hahn of Berlin, in 1881, published an account of the first operation for fixing a movable kidney.

Centuries ago it was made the subject of a chapter by Mesue, of Venice (*see* editions 1497, p. 187, and 1561). Other ancient writers on the mobility of the kidney are Francis Pedemontanus, in 1581 and 1623 (p. 75), and Riolan, in 1682.

In modern times Gigon of Angoulême, Rayer, Fitz, Dell, Landau, Newman, and many others have described the symptoms which it causes, and have pointed out the relation between movable kidney and hydro-nephrosis.

Natural movements of the kidney. — A certain limited amount of movement in a vertical direction is natural to the kidney in each one of us; it ascends with expiration and descends with inspiration; it descends also, slightly, by the force of gravity in the upright position. Movements the result of deep respiration can be detected on bimanual examination in thin persons whose thoracic walls are not unusually long or deep; they are daily witnessed by surgeons accustomed to operate upon the kidney, and can easily be demonstrated on the dead body as soon as the abdomen is opened and before any of the viscera are removed.

The range of the natural movements varies with the sex and in different persons of the same sex; but it probably does not much exceed an inch or an inch and a half. It is greater in the female than the male, a difference which Rosenthal states exists in infancy and young life as well as in the adult. This is not what would have been expected considering that in young children, males and females alike, the type of respiration is the abdominal;

and in women the type of respiration is what is called *superior costal*, *i.e.* the movements of respiration are less extensive in the lower and more so in the upper part of the chest ; whereas in man it is the *inferior costal* type, *i.e.* the whole chest and the sternum, as well as the diaphragm, are subject to a wide movement in inspiration. An anatomical reason for this greater mobility in females is, however, afforded by the observation of Deletzine and Volkoff (*Méd. Mod.*, Mars 10, 1897), who point out that in the female the renal fossa is not so deep and its width at the inferior part is much greater.

Natural means whereby the movements of the kidney are restrained.—The kidney, unlike the liver or the uterus, has no special ligaments for keeping it in its place, and very varied opinions have been advanced by different writers as to how this is effected. We will not enter into a discussion on this subject. It will be sufficient to refer the reader to Chapter I. for a description of the renal pedicle, the fatty capsule of the kidney, the perinephric fascia, and the vertebro-costal ligament. Though all these structures, together with the peritoneum and, last not least, the intra-abdominal pressure, take part in retaining the kidney in its normal position, it is, probably, to the way in which the kidney is packed in its fatty cushion within the perinephric fascial sheath (Figs. 21 and 22, pp. 103 and 104), rather than to any other single factor, that the chief importance must be attached. In the infant the fatty capsule does not exist, and it is the peritoneum which is the chief agent in giving fixity to the kidney.

What is meant by movable and floating kidney.—The distinction made between a movable and a floating kidney is not the same with all who use the terms. Some have given to them an anatomical, some a clinical definition. Those who use the term floating kidney with an anatomical meaning include under it only the kidneys which have a distinct mesentery—a mesonephron ; whereas those who give to it a clinical significance imply that the movements of the kidney are such as permit it to rise or float towards the anterior abdominal walls, whether it has a mesentery or not.

The committee of the Pathological Society of London, appointed to inquire into the matter of displaced, movable, and floating

kidneys, found evidence to show that "the peritoneum may be flaccid and loose to such an extent as to allow the kidney to move under it so as to come in contact with the walls of the belly; or to leave its natural place and pass to or below the brim of the pelvis, or, indeed, in some cases to encroach upon the opposite side of the belly. A like mobility or "floating" of the kidney may be due to the presence of a mesonephron."

The committee, taking into their consideration the clinical resemblance of all very freely moving kidneys, whether they have a mesonephron or not, and also the fact that "both these anatomical varieties merge by insensible degrees into one another," would style every very mobile kidney "floating," no matter what its anatomical relations to the peritoneum; and every slightly or moderately mobile kidney "movable." Other writers, like the late Sir William Jenner, consider "a floating kidney is a kidney that has a mesentery, a fold of peritoneum attaching it very loosely to the spine; a floating kidney can be moved about to a considerable extent, to the extent of the length of its mesentery. A movable kidney can only be passed up and down a little; it slips a little under your fingers."* But this is to confuse the anatomical and clinical features, and to leave out of sight those equally "floating" kidneys which have no mesentery. It implies that the degree of mobility depends on the presence or absence of a mesonephron; and therefore that a clinical difference indicates an anatomical distinction, which is not by any means correct.

In my former book on the "Surgery of the Kidney" (1885), I adopted the strictly anatomical definition because at the time of writing the few surgeons who had operated upon the kidney were divided into two groups, namely, those (1) who advocated the lumbar or extra-peritoneal operation, and (2) those who preferred the trans-peritoneal or intra-peritoneal; and it was only right that one of the earliest and most inflexible of the advocates of the lumbar method, when writing on the subject of movable kidney, should candidly recognise the cases in which an operation could not be performed without opening the peritoneal cavity, and in which therefore the objections made against the trans-peritoneal method as an operation for general adoption did not, in their entirety, hold

* *Brit. Med. Journ.*, vol. i., p. 43 (1869).

good. But to-day, when surgeons almost uniformly practise the lumbar operation for all cases except for large renal tumours and some few other very exceptional conditions, there is no object in emphasising a rare anatomical feature connected with the peritoneal covering of the kidney, which is entirely without any real practical importance. We shall here use the terms, therefore, with a strictly clinical meaning.

A "movable kidney" is one which moves abnormally freely behind the peritoneum. The peritoneum should, normally, only pass over its anterior surface and overlie the anterior layer of the perinephric fascia. The natural movement of the kidney takes place within the tunica adiposa. The abnormal movements occur behind the peritoneum in three forms. If the natural movement simply becomes exaggerated the kidney is said to be "movable," but it still moves only within its own fatty capsule. In other instances the adipose tissue, being more firmly connected with the proper fibrous capsule of the kidney, moves with it within the perinephric fascia. The third condition is where the kidney moves within the fatty capsule and that again within the sheath of perinephric fascia.

The "movable" kidney is entirely shut out from the peritoneal cavity, it does not hang or project into it like the small intestines or the cæcum, for example, do; it occupies its position between the peritoneum in front and the muscular parietes behind; but within this position the kidney moves more or less freely and widely. There is no, or no appreciable, movement forwards, no "floating" towards the anterior abdominal walls. These are the commonest forms of moving kidneys; they are the most difficult, indeed are often quite impossible to detect clinically or until the loin is opened in the course of an exploratory operation. These include the cases which I am in the habit of describing as kidneys with a "cinder-sifting" movement.

A "floating kidney" is one which, whether it possesses a mesonephron or not, moves freely forwards—so as to rise or "float" towards the anterior abdominal wall—as well as vertically and laterally; this "forward" movement or "floating" makes the distinction between it and the "movable" kidney. It is not possible to distinguish until the abdomen is opened, or the kidney is explored through the loin, whether a floating kidney has a mesonephron or not.

A floating kidney with a mesonephron is of course always congenital, and is necessarily associated with an elongation of the renal vessels. In some cases of floating kidney with a mesonephron it has been noticed that all the processes of the peritoneum were unusually long; the foramen of Winslow very large owing to the laxity of the gastro-hepatic omentum; the great omentum very large, and the mesocolon long and lax. It is possibly true of this class what Glénard says of nephroptosis generally, namely, that enteroptosis may exist without nephroptosis, but not nephroptosis without enteroptosis. The statement is certainly not correct if applied to " floating " kidney without a meso-nephron, and still less is it so if applied to " movable " kidney as well as floating kidney. In ninety-eight* cases of movable or floating kidney which I have operated upon, the number in which anything approaching hepatoptosis or enteroptosis was present could be counted on the fingers of one hand.

A floating kidney without a mesonephron may be acquired and the renal vessels become elongated. Thus a " movable " kidney which for a while had been limited to an up-and-down movement may by degrees become a " floating " kidney owing to the loosening of the peritoneum from the lumbar portion of the abdominal wall; but though the mobility of such a kidney may ultimately equal in extent that of a kidney with a mesonephron, the change in the relation of the peritoneum to the kidney does not convert it into or make it resemble a true mesentery or mesonephron. A floating kidney with a mesonephron is very much less common than one without a mesentery: indeed it is excessively rare. It has been repeatedly asserted that a true mesonephron has never yet been observed, and does not occur. But the term mesentery does not imply anatomically a complete investment of the whole organ by the peritoneum, otherwise it could not be applied to the peritoneal covering of the cæcum and colon. The layers need not actually meet behind; they still form a mesentery if they cover the poles and borders and

* Though the number of my operations for movable kidney has been increased since this was written, and the number of cases of movable kidney as to which I have been consulted still more so, yet the number of cases in which enteroptosis existed has been quite infinitesimal; and in not one of the more recent cases has there been marked mobility of either the liver or intestines or spleen.

a considerable part of the posterior surface of the organ. Those who deny the occurrence of a mesonephron must have overlooked some illustrative published cases.

Dr. William Henderson * of Clifton, reported a case in which the right kidney was found perfectly movable, and suspended "by a prolongation of the peritoneum enclosing the kidney and forming a distinct mesentery, which allowed it to move in all directions." Dr. Priestley † recorded a case in which the peritoneum formed a distinct mesentery for the kidney. More recently (in April, 1883) Dr. Lindsay Steven showed a specimen of kidney with a partially formed mesonephron, at a meeting of the Glasgow Pathological and Clinical Society.‡ The line of attachment of the renal mesentery in Dr. Steven's specimen corresponded to the upper half of the internal border, and a small area of the upper portion of the posterior surface of the kidney. The movement of the lower part of the kidney was thus much more free than that of the upper.

In Mr. Keetley's § case the right kidney of a woman, aged sixty-eight, was found to have two layers of peritoneum forming what resembled a mesentery ; they were independent of each other behind, but they covered the kidney so as to move with it freely in all directions. The kidney did not simply move behind the peritoneum.

For convenience of description the terms movable and floating kidney will be used indiscriminately, except when one or the other type is specially referred to ; it will then be designated by the term " movable behind the peritoneum," or " floating kidney without a mesonephron," or " floating kidney with a mesonephron," as the case may be.

Pathological anatomy.—Sometimes the adipose capsule of the kidney is large and loose, and permits of the movement of the organ within it ; in other instances it closely surrounds the kidney, and moves with it ; whilst in others again the kidney moves within its adipose capsule, and the capsule also moves about with the kidney behind the peritoneum. The amount

* *Med. Times and Gaz.*, vol. ii., p. 501.
† *Ibid.*, vol. i., p. 262 ; 1857.
‡ *Glasgow Med. Journ.*, Oct., 1883, p. 309.
§ *Path. Soc. Trans.*, vol. xxvii., p. 469.

of fatty tissue varies very much; in the most movable cases there is often little or none; but a considerable amount of mobility of kidney is consistent with a fair amount of fat when the two move together within the perinephric fascia. The fatty tissue is soft and very fine; if it becomes tough and fibrous, the kidney tends to become more fixed.

The peritoneum.—If the kidney floats it is either owing to its possessing a mesentery, or to the peritoneum becoming elongated by continuous dragging upon it by the weight of the kidney after it has once begun to lose its natural fixity of position. With the yielding of the peritoneum the anterior layer of the perinephric fascia also yields. There are all degrees of yielding, between the mere looseness which allows of the kidney unduly moving behind the peritoneum, and its floating freely towards the front of the abdomen or across the median line with all the freedom it would possess with an elongated mesentery.

In some cases the peritoneum congenitally has a more extensive connection with the kidney than usual, covering its convex border and advancing more or less over the posterior surface. In these intermediate forms there is no mesonephron, and owing to some irregularities in the arrangement of the peritoneum the kidney may not be even covered on its anterior surface by the peritoneum, but be unsupported and free to move between diverging processes of the peritoneum. The case published in Mr. Durham's article in the *Guy's Hospital Reports* (3rd series, vol. vi., p. 413), is one in point.

The kidney.—The structure of the kidney is normal, or if it be not so the pathological change in it is usually entirely independent of the mobility. There is one pathological condition, however, which is due to the mobility, and which is not seldom met with by the surgeon when performing nephropexy. It is a certain degree of flabbiness and softness of the renal tissue due to sacculation of the calyces from frequent moderate renal retention. These are cases of commencing or early hydro-nephrosis which give no clinical sign of an enlargement. I have on some occasions, where with the mobility there has been intermittent fulness or hardness over the renal region, found the kidney so advanced towards hydro-nephrosis that I have hesitated between fixing or removing the organ: and in one case the kidney was

subsequently removed because the fixation, which was very complete and extensive, failed to relieve the intermittent attacks. It is more than probable that in some cases where hydronephrosis has been present with a movable kidney there has been some other overlooked condition, such as a valve or stricture or an abnormal renal vessel, which was the cause of the hydronephrosis, whilst the latter, in turn, was the cause of the mobility. Since my attention was first directed to Küster's and Fenger's plastic operations on the ureters I have always looked for and on several occasions found one or other of these causes present ; in some of the cases I have corrected the obstruction before fixing the kidney, in others in which the atrophy of the parenchyma has been very advanced I have performed nephrectomy.

A floating or movable kidney may contain one or more calculi, or may be associated with pyo-nephrosis or pyelo-nephritis; and though these may be coincidences, still we must recognise the fact that in a person with a movable kidney and a tendency to lithiasis the renal retention which the mobility of the kidney so often occasions may induce the deposition of some of the urinary salts from the retained urine. The renal retention and the congestion and engorgement of the kidney which occur with the crises of a floating kidney may also induce a condition favourable to septic micro-organisms, and thus a hydro-nephrosis may be converted into a pyo-nephrosis, or a suppurative pyelo-nephritis may be started. Such morbid changes, however, bring the patient under notice not for mobility of the kidney but for the symptoms due to the calculus or the suppurating process.

The ureter.—Gigon, in 1856, gave the explanation of the occurrence of hydro-nephrosis with movable kidney. He attributed it to the kinking of the ureter, which, fixed by the peritoneum, cannot follow the kidney in its wanderings ; and thus a curve is formed with its convexity upwards, which becomes the more pronounced as the kidney falls lower and lower. Gigon thought this curvature might render the passage of urine, temporarily, even quite impossible. Landau, Terrier, and Baudoin have accepted or revived this explanation, and it has become established as an accepted fact by the observations and published records of many surgeons. This curving of the ureter can be shown to take place in the dead body when the kidney is pushed

downwards; and Legueu found that the curvature was pro-
duced when the ureter followed the kidney in its displacement.
Navarro and Tuffier have demonstrated experimentally, by mobi-
lising the ureters of dogs, that ureteral curvatures are followed
by renal retention. Further proof of the same fact, though
less convincing, is furnished by the observation of Albarran,
who found, when catheterising the ureter in two women with
mobile kidneys but no hydro-nephrosis, that the catheter, which
was arrested at the height of 12 to 15 cm., could be made to
penetrate further on raising the kidney. Still it cannot be
assumed that in every case of curvature there will be renal re-
tention, or, conversely, that renal retention in a mobile kidney
is in every case caused by kinking or a curve of the ureter. On the
one hand the case I. record in treating of the ureteral anastomosis
(see Fig. 184, p. 545, Vol. II.), in which there was a very considerable
curve of the ureter of a mobile kidney made permanent by tough
adhesions, but without any trace of there having been renal reten-
tion; and, on the other hand, the by no means very infrequent
association of mobile kidney with hydro-nephrosis from valve
formation or stricture, warrant this opinion. Nor can it be held
as proved that in every case, in which the kidney is movable,
the mobility is the primary cause of the curvature. So far as
clinical observation alone can inform us (which I admit is not
convincing evidence because of the impossibility of being sure that
the kidney had not the " cinder-sifting " movement long before it
was detected as a movable kidney) the mobility itself and the
curvature are in many cases secondary to some other renal lesion,
such as calculus, nephrectasis, or tumour. Sight ought not to be
lost of the possibility that a hydro-nephrotic or other form of
enlarged kidney may become movable by its weight or otherwise.
Thus, W. Walter (Manchester) records a case in which nephrectomy
was performed for a floating cystic kidney. The patient was a
woman, aged forty-two, from the lower part of whose kidney there
projected a cyst containing ten ounces of a pale straw-coloured
fluid of sp. gr. 1013, and highly albuminous. A tumour had existed
for six years, but had caused no trouble till three years after it
was first noticed.

Associated movements of other abdominal viscera.—In my
earlier work it was mentioned that in some cases of floating

kidney the foramen of Winslow was very large, the great
omentum and mesocolon large and long, and all the pro-
cesses of the peritoneum unusually long. Landau found that
at least half the patients with movable or floating kidney
have prolapse of the uterus or vagina, or cancer, or retro-
flexion of the uterus, hernia, or weakness or laxity of the
perineum or abdominal walls. Glénard, in an elaborate work
on enteroptosis, has pointed out the frequency with which the
liver, intestines, and kidney of the same person are suspended at
a lower level, unduly lax in their positions, and movable. He
has described four degrees of nephroptosis, and expressed the
opinion that nephroptosis never exists without enteroptosis.*
Ewald, on the other hand, in a review of what has been written
on Glénard's disease in France and Italy, arrives at the conclusion
that there is no relation between nephroptosis and general splanch-
noptosis in the sense that the former must be unconditionally
followed by the latter. The conclusion of Ewald is the one
which will most commend itself to surgeons who see much of
kidney surgery and movable and floating kidneys. My own
personal experience is that the persons who consult a surgeon
on account of a wandering or movable kidney are as a rule free
from undue mobility or ptosis of any other abdominal organ. I
have only once been consulted, with a view to the question of
treatment of a mobile kidney, where the patient was considered
to be the subject of enteroptosis. This patient was sent to me
by a physician as a case of Glénard's disease. She was a woman
with very lax abdominal wall, a very movable kidney, and a
somewhat movable liver. She was quite relieved of all her symp-
toms, both renal and intestinal, by nephropexy, and remains well
now several years after the operation.

I have twice operated in cases with very marked hepatoptosis
without movability of kidney. In a few cases I have found the

* Glénard, "Les Ptoses Viscérales," 1899. Glénard writes upon the
influence exercised by the respiratory movements upon the mobility of
the kidney with all the portentousness of having made a discovery.
Originality is simplified by overlooking what has previously been done by
others. Reference might have been made to the writings of Dickinson,
and to pp. 27, 34, 486, 490 and 491 of my "Surgical Diseases of the
Kidney," which was written in 1883–84 and published in November, 1884,
a year or two prior to Glénard's first papers on the subject.

liver movable with a moving right kidney, and in one case in which I fixed a movable left kidney the spleen was movable and much lower in position than normal, though capable of being pushed up.   Cunningham has noticed adhesions to the colon of a movable kidney ; and in Durham's case, mentioned above, the floating left kidney was associated with, and Durham thought was caused by, the malposition of the descending colon.

Associated defects and deformities.—Besides the abnormalities of the renal vessels, persisting fœtal lobulation, and an occasional malformation of the kidney itself (Herczel), malformations of the colon and liver (Pasteau), varicose veins (Tuffier), and marks of physical and mental degeneracy (Albarran) have been noticed in persons with wandering kidney.   Albarran, who has elaborated a " theory of degeneration " or congenital predisposition to nephroptosis, supports it by these associated deformities and the occasional occurrence of movable kidney in different members of the same family (Stapfer).

The *vessels* of the kidney may be elongated, but in other respects are, as a rule, normal.   The elongation of the renal artery and vein is often seen in operations, and has been repeatedly found in post-mortem examinations.   The renal artery has been met. with nearly five inches in length, and Tuffier states that in one case the right renal vein was long enough to allow of the kidney being drawn through the lumbar wound as far as to the patient's buttock without causing any traction upon it.   The artery is more frequently elongated than the vein.   When the kidney is drawn through the lumbar wound the vena cava yields somewhat to the traction and presents a marked convexity at the level of the attachment of the vein and on the side of the traction.   In the acquired cases of floating kidney (those without a mesentery) the elongation of the vessels is also as a rule acquired. This is shown by their undue slenderness as well as their undue length.   Durham noticed this condition, and it has since also been observed in other cases.*   An abnormal origin of the artery of a movable kidney suggests the congenital nature of the mobility. The *suprarenal capsule* commonly does not move with the

* Leguen, Soc. Anat., 1895, p. 565 ; Gosset et Glantenay, Soc. Anat. 1897, p. 216   Pasteau, Soc. Anat., 1897, pp. 213 and 269 ; Watson, *Journ. of Cutaneous and Genito-urinary Diseases*, 1897 p. 315.

kidney, and, except as regards its relation to the kidney, occupies
its natural situation in the body.

The extent of movement varies greatly. As stated above, a slight
degree, *i.e.* an inch or thereabouts, inwards, upwards, or down-
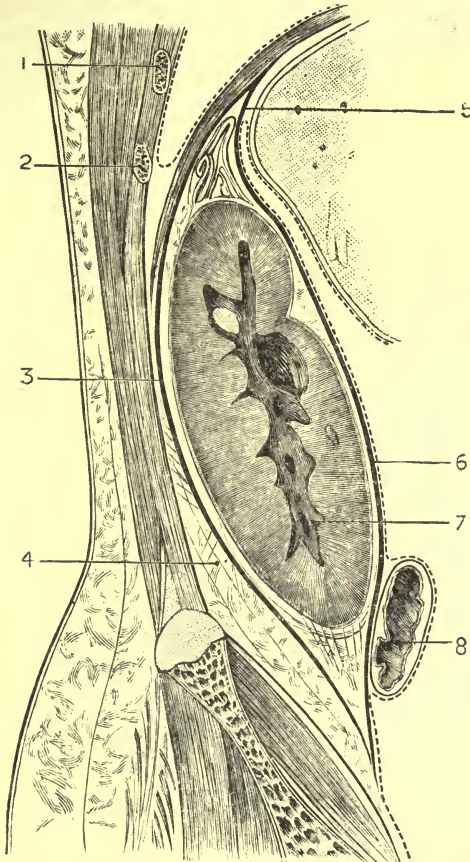
Fig. 21.— Longitudinal Section showing the arrangement of the capsule of the
Kidney. (*After Gerota*).

1, 11th rib ; 2, 12th rib ; 3, posterior lamellæ of the peri-renal fascia ; 4, fat situated behind peri-renal
fascia ; 5, insertion of the anterior and posterior lamellæ of the fascia to the diaphragm ;
6, anterior lamellæ of the peri-renal fascia ; 7, vessels of the hilum of the kidney ; 8, section
of colon.

wards is not abnormal, but the kidney is prevented from moving
outwards by the normal arrangement of the perinephric fascia
(Figs. 21 and 22). The degrees of abnormal mobility are: (1)
when the kidney moves up and down so that the lower half comes

between the fingers of the two hands during deep inspiration;
(2) when the greater part or even the whole of the kidney can
be grasped during a deep inspiration, but ascends again during
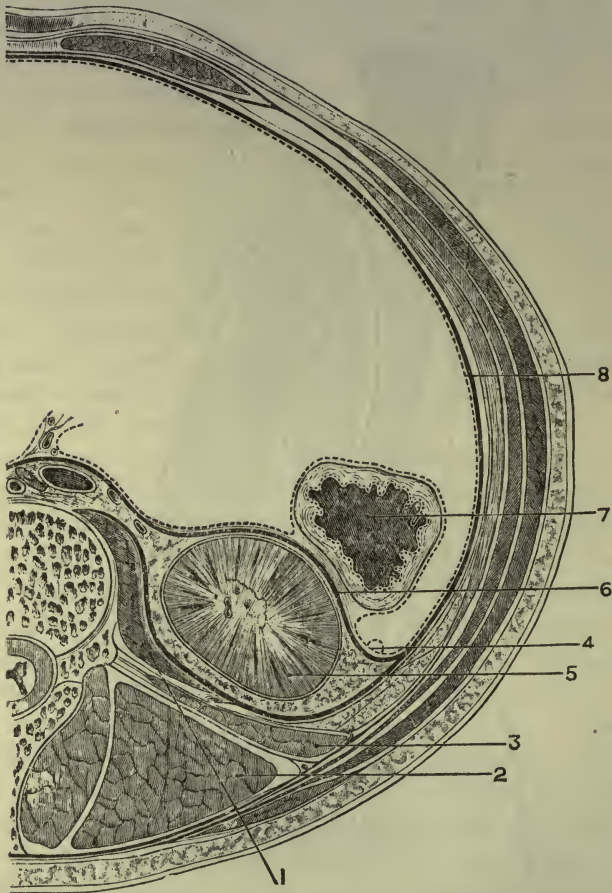
Fig. 22.—Transverse Section showing the relations of the Capsule of the Kidney.
(*After Gerota*).

1, Psoas ; 2, sacro-lumbalis group ; 3, quadratus lumborum ; 4, peritoneum ; 5, kidney ; 6, anterior
lamellæ of the peri-renal fascia ; 7, colon ; 8, sub-peritoneal fascia.

expiration; (3) when the whole kidney descends below the exam-
iner's fingers and can be retained below them after the patient
makes a full expiration. In some of the more extreme cases the
kidney is often out of position during natural respiratory movements.

The peritoneum may be sufficiently loose to allow the kidney to fall below the brim of the pelvis, or against the anterior abdominal parietes, or across to the opposite side of the spinal column, moving through a circle with a diameter of eight or nine inches.*

It is evident, therefore, that the greatest freedom of movement does not of itself indicate that the kidney possesses a mesonephron, or that the peritoneum covering the kidney is in any way abnormal except in the greater laxity of its attachments—the perinephric fascia and the subperitoneal fatty tissue of the loin also being abnormally loose.   A kidney without a mesonephron having as great a range of movement as a kidney with a meso-nephron may give rise to all the same clinical features.

The kidney in some cases, besides moving vertically and laterally, has also a rotation movement either round a transverse axis through its hilum or round a vertical axis.   In the former case it is the lower pole usually which swings forwards and inwards, and this is by no means very uncommon combined or other-wise with the lateral and vertical movements.   Sometimes, but more rarely, it is the upper pole which comes inwards and for-wards.   In the vertical rotation the convex border advances.   The moving kidney may also be deformed or flexed upon itself by adhesions from slight perinephritis, or as the result of a former nephrotomy.   I have elsewhere mentioned a case where the two poles were approximated towards the hilum.

Etiology.—The callings of persons do not seem to have any bearing on the causation of movable kidney.   Statistics differ as to the frequency of its occurrence : Ebstein and Neu-mann, whose figures are based on post-mortem records, taken to-gether, give 16 cases in 14,698 autopsies.   Judging from the records of my own hospital, these figures are unreliable, because, unless the mobility were actually sought for in each body, only the most striking cases would attract notice.   Its frequency in the living female is variously stated between 3 and 46 per cent.   Edibohls records 90 cases in 500 women.   Glénard, who saw 537 cases in eight years, gives the percentage at 22 in every 100 women.†

* Dr. Bindley's case, *Path. Soc. Trans. Lond.*, vol. xxvii., p. 473.

† These figures of Glénard are based upon the assumption that every kidney is "movable" the lower pole of which can be grasped between the fingers of the two hands on the patient taking a deep inspiration.

Lindner and Küttner consider 20 per cent. of women are affected. Probably 7 to 10 per cent. is near the mark. In men the proportion is less than 8 per cent. Skorczewsky states that in 1,422 patients whom he examined during life, 32 females out of 1,030, and 3 males out of 392, were the subjects of mobility of kidney. But it is hardly necessary to say that inferences drawn from clinical examination of the abdomen do not carry with them the conviction of post-mortem inspection, if the inspection is made with special reference to the question of mobility. On the one hand, it is impossible to say after palpation that the kidney is only normally movable; whilst on the other, the diagnosis of movable tumours of the abdomen is admittedly difficult, and in many instances what has been positively asserted to be a mobile kidney during life has, on post-mortem examination, or on the operating table, turned out to be something very different. It is quite certain, however, that the greater number of persons whose kidneys are unduly movable know nothing about it and do not suffer in the least from it. But it is far from uncommon to find after death that a kidney is mobile, though it was not known to be so during life.

Pathogenesis of movable kidney.—Deletzine and Volkoff, at a meeting of the Society of Russian Physicians of St. Petersburg in 1897,* stated as the result of certain observations and experiments made by them on the dead body: that the cadaver being placed vertically and the abdomen opened in this posture it is seen that the kidneys descend very little unless the vessels or ligaments are elongated; that neither the diminished resistance of the abdominal walls, nor the increased weight of the kidney, nor the wasting of the perirenal fatty tissue permits the descent of the organ unless a mesonephron is present; and that the adipose capsule is not an obstacle to renal ptosis. The rapid evacuation of a septic fluid, repeated pregnancy, pneumothorax, and artificial employment of respiration favour displacement of the kidney (Litten and Israel); traumatism in the renal region plays a very important rôle in etiology. Casts show that the renal couches are not so deep (long) in women as in men but are wider below in women; and that they are also more superficial and wider on the right than on the left. Ectopy of the kidney is essentially

---

* See La Médecine Moderne, No. 20, Mars 20, 1897, p. 158.

connected with these modifications of form of the " loges " of the kidneys.

It is certain that the proportion of women affected is greatly in excess of the males, and this more especially in the severer forms of mobility. Here again the figures vary greatly. Out of 1,176 cases collected by Legry, 87 per cent. were in women, whereas Lanceraux's and Landau's figures, added together, give 330 females to 50 males, or 1 male to every 6 or 7 females. Skorczewsky's figures show the relative proportion to be 1 male to every 4 or 5 females. Certainly men rarely, as compared with women, require nephropexy. My own operation list shows 98 operations for movable kidneys, 88 being performed upon women and 10 on men: thus only 11·3 per cent. were males, or 1 male to every 8·8 females. The right kidney is from twelve to thirteen times more often affected than the left. The reasons assigned for the greater frequency of the mobility of the right kidney are the weight of the liver, its little proneness to yield to tight lacing, and its descent with every act of deep inspiration ; the greater length of the right renal vessels ; and the fact that the ascending colon is less firmly bound to the right kidney than the descending colon is to the left. Zuckerkandl has described an aponeurotic layer which lines the peritoneum on the anterior surface of the left kidney and, he considers, contributes to fix it. The connection of the left suprarenal capsular vein with the renal vein gives the left kidney a further mainstay, as the capsule remains in its position and does not follow the kidney in its abnormal movements. Both kidneys are involved about once out of twenty cases (Landau). Schiff, Heslop, Wiltshire, G. Hunter, and others, have recorded cases of mobility of both kidneys, and of double kidneys. I have operated upon several women for fixation of both kidneys.

Between 80 and 90 per cent. of the cases occur between the ages of twenty and fifty, the greater proportion of them being between the thirtieth and fortieth years. Many writers speak of cases of movable kidney in girls, some have noticed cases in infants, Stiller* in children of six, nine, and ten. Rosenthal collected twenty-six cases in young girls. Herczel records one in a girl of eighteen, Guyon one in a girl of twenty.

* Stiller, *Wiener Med. Woch.*, 1889, Nos. 4 and 5.

M. Comby and M. Guinon* brought to notice several cases
in girls between one month and fourteen years. Comby
collected in a few months six such cases. Several of the little
patients had marked dyspeptic troubles and dilated stomachs,
engorgement of the liver and ptosis of the other abdominal
viscera. In two of the patients, the subjects of hereditary
syphilis, both kidneys were movable. The symptomatology of
movable kidney in children is the same as in adults.

Herczel gives three reasons why the majority of cases occur be-
tween twenty and forty, namely, (a) the fluxional hyperæmia of
the kidney at the catamenial period; (b) childbirth; (c) ectopia
of the genitals. Küttner thinks movable kidney as frequent
in young girls and women who have never borne children as in
others. Müller, Warneck and Lindner also refer to the frequency
of movable kidney in nulliparæ, and on that ground oppose
the theory that relaxation of the abdominal walls produces it.

In women the affection very commonly arises during the
child-bearing period and just subsequent thereto. Pregnancy
has a share in its production, and a very large proportion of the
cases occur in women who have borne children quickly or nu-
merously. The condition, however, is not uncommon in women
between twenty and twenty-five who have never been pregnant.

The way in which pregnancy conduces to movable kidney
is (1) by the sudden loss of intra-abdominal pressure after delivery;
(2) by the forcible contractions of the diaphragm during par-
turition and the consequent downward pressure more especially
exercised on the liver and right kidney; (3) by the subsequent
loss of muscular resistance in the abdominal walls and their
pendulous flaccidity after parturition (Hertzka, Landau, Senator,
and others); and (4) by the too early resumption after delivery
of the erect posture, and of physical occupation, without wearing a
proper abdominal support: hence it is that the movable kidney is
rather more often found amongst the poorer classes. It has been
repeatedly stated by those who have had good opportunities
of judging that at least 10 per cent. of the poor women of Austria
and of Holstein who have borne children have a movable kidney.

Becquet believes that the kidneys are associated with the
generative organs by means of the connection between the

* *La Semaine Médicale*, p. 200, Mai 26, 1897.

plexus ovaricus and the plexus renalis in the congestion which affects them during menstruation ; and that in this way their displacement is the consequence of the changing volume and weight of the kidney. Similarly he explains the renal pain which is so often felt at the menstrual periods, especially by those subject to dysmenorrhœa Certain it is that there is in many cases an increase during menstruation in the severity of the symptoms, and in the sense of weight and dragging experienced by some women with movable kidney. I have on several occasions observed a remarkable increase in the size of a movable kidney during the menstrual period, and in one case under my care the late Sir Matthews Duncan mistook a movable kidney during the catamenia for a malignant tumour of the kidney, and he readily acknowledged the error of diagnosis after examining the patient again a few days later. Herczel also attaches importance to the fluxional hyperæmia of the kidney during menstruation as a cause of movable kidney. Glénard and Tuffier state that the painful movable kidney is one phenomenon of an organic defect of all the tissues, and is often associated with laxity of other organs, and not infrequently is but one symptom of the general condition known as entero-ptosis or Glénard's disease, in which all the principal abdominal organs are found to have dropped to a lower level, owing to a relaxation of their ligaments and of the abdominal walls. The connection between general intestinal ptosis and movable kidney, as taught by Glénard, is, however, not at all well established. Ewald's opinion against it has been quoted before, and Guttman and Senator regard it as rare. Albarran's experience, like my own, is that the great majority of cases of nephroptosis are independent of enteroptosis.

Rapid general emaciation and the absorption of the fatty elements of the adipose capsule of the kidney, even in persons not emaciating in other parts of the body, as well as a primative deficiency of the perinephric fatty tissue, favour, if they do not determine, the mobility of the kidney. Keen* confirms this view.

The deficiency in the fatty capsule of the kidney I believe to be one of the most important of the causes of movable kidney, especially the absence or loss of the thick mass of it at the lower

* *Annals of Surgery*, August, 1889.

pole of the organ. Certainly, of the cases which I have operated
upon the kidney has been most movable in those who have
lost much fat or who have always been spare. The type of
woman who, in my experience, has the most suffering from this
affection is the spare, slender, small-waisted figure with a long
thorax. In many of the cases in this type of physique there
has been no fatty capsule to clear off the kidney, which has sud-
denly shot out through the wound as soon as the parietes have
been cut through and a little pressure has been exerted on the
front of the organ.

Riolan, writing in 1682, said, "The cause of this" (displace-
ment and falling forwards of the kidneys) "arises, not only from
the diminution of the fat with which they are enveloped, but
also from the fact that, having become too large and heavy,
in consequence either of tumours developed in them or of stones
included in their pelvis, they are borne down by their own weight."
The latter part of Riolan's explanation may account for the not
very rare association of movable kidney and hydro-nephrosis.
Mesue, writing in 1561, also had insisted on the mobility of
the kidney consecutive to renal tumour. One of Herczel's cases
is etiologically interesting in reference to spinal curvature from
rachitis. The left kidney first sank and became abnormally
movable, whereupon intermittent hydro-nephrosis appeared from
temporary obstruction of the ureter caused by slight bending
and twisting of the tube. He thought movable kidney and
hydro-nephrosis are often associated. Tight lacing, by the inter-
mittent compression of the waist by the corset, is another probable
cause. Deletzine and Volkoff * have made an exhaustive study
of the renal fossæ by measurements and casts, and they find
that in well-formed females the renal fossæ are narrower and
more open below than they are in men, and therefore a dis-
location of the kidney by violence or by corset pressure is more
apt to occur. Cruveilhier states that he has often observed
the right kidney to be mobile, and likewise displaced a long way
from its natural position, in women who have worn tight stays
Mobility may be associated with the misplacement from this
cause. Koranye has also insisted on the injurious effect of corsets,
and of shoes and boots with high heels. Velpeau discovered

---

* *Die Wanderniere.*

a movable kidney in the right iliac region of a woman who subsequently died of peritonitis ; the misplacement of the kidney was presumably caused by the drag of a hernia of the cæcum into the femoral sac (Rayer). Bartels was the first to call attention to the frequent co-existence of movable right kidney and dilatation of the stomach. Litten noticed the frequent co-existence of dilatation of the stomach and nephroptosis. In forty cases of dilatation of the stomach he found twenty-two cases of displaced kidney, and he considered the dilatation of the stomach the primary affection. Ewald, Osler, Nothangel, and others admit the frequency with which the two conditions co-exist, but consider it a mere coincidence. Küttner, Linder, and others consider that floating kidney is either a congenital anomaly or at any rate that there is a strong congenital predisposition. Tuffier and Albarran attach much importance to the congenital theory.

Finally, in many instances the immediate cause of the mobility has been of a traumatic nature, such as a blow or kick on the loins, a jerk, or some severe and sudden concussion. A military officer who fell upon his feet from a horse suffered a violent concussion of his entire body, and subsequently both his kidneys became movable (Henoch). Such cases are more like dislocations. But in other cases in which the mobility has been attributed to violence the injury was inflicted years before the first symptoms, so that the abnormal movement must have been very slowly developed. Arnim mentions a case in which the woman was tossed by a bull twenty-one years before, Kispert one in which a woman fell off a mule eleven years before, and in a case of my own the patient was thrown off a camel between two and three years before I removed her kidney for a large movable hydro-nephrosis. Violent or repeated coughing, constant and sudden straining efforts, a sudden twist or flexion of the body are other slighter traumatic causes to which the undue mobility has been attributed.

Symptoms.—The symptoms of a movable kidney are of two kinds, viz. the subjective or those experienced by the patient, and the physical or those which can be detected by the hand of the surgeon. In the mild cases there is often an entire absence of any sign whatever, and the condition, as has been stated, is only discoverable on post-mortem examination. In cases of

a more severe form, but in which, owing either to the stoutness of the patient or to the movement of the kidney being only in a vertical or lateral direction, no physical signs are de-tectable, the subjective symptoms may be acute.

Pain.—Movable and floating kidneys give rise to more or less con-tinuing pain, to renal crises, manifold disturbances of the digestive organs, of the heart and large blood-vessels, of urinary secretion and micturition, of biliary excretion, of intestinal functions, and of the nervous system. The symptoms arise partly from the mis-placed organ itself, and partly from the effect of the misplacement on the surrounding viscera. Some of the most common symptoms complained of are a constant or frequent sensation of pain and dragging or weight in the loins and side of the abdomen, pain between the shoulders and at the back, stiffness of the back and sense of dragging from the side affected, an occasional sense of something moving, which in severe cases has been described as resembling the movements of a fœtus *in utero.* Rosenberger speaks of continued crampy pains in the abdomen. Acute paroxysms of intense pain resembling renal colic, dull aching pains in the loin or abdomen, and neuralgic pains in the course of the great nerve trunks of the affected side (Rayer), may all occur. The pain sometimes disappears on lying down, but may be aggravated if not actually induced by walking and standing. In some cases the pain becomes gradually worse and remains severe even for hours after assuming the recumbent posture.

Gastro-intestinal disturbances.—Disturbances of the digestive system are especially prominent ; vomiting, often frequent and severe, sometimes preceded by a burning sensation in the epigastrium, together with symptoms of gastritis and sometimes actual dilatation of the stomach, occurs ; in the large intestine the most common condi-tion is one of obstinate constipation which may in some cases amount to temporary obstruction ; occasionally there is irregularity of the bowels or diarrhœa. All these symptoms are probably produced either by actual pressure or by the dragging of the misplaced kidney upon the intestine. Folds of peritoneum have been ob-served passing from the kidney to the duodenum in such a way that when they are pulled upon, the lumen of the duodenum is narrowed or even occluded, as in a case recorded by Franks. Macalister, who has also observed similar folds, believes that

they are by no means uncommon and that they furnish a natural
and adequate explanation of the gastric disturbances which occur
in these cases. The gastric symptoms are liable to acute ex-
acerbations or " crises," as first described by Dietl in 1864. They
consist of violent attacks of colic attended by nausea and vomiting,
and these may be accompanied by abdominal distension and
tenderness, and sometimes by a rise of temperature and signs
of collapse. These renal crises are variously attributed to
twisting and traction on the renal vessels or on the nerves of
the pedicle, and to curvature and torsion of the ureter. Often
all these conditions exist at the same time in different degrees,
and thus cause renal congestion, digestive disturbances and pain
through the sympathetic plexus, and renal retention of urine.
The crises do not depend on the amount but on the direction of
displacement, and are produced by rotation as well as by other
occasional movements. Transient attacks of jaundice are said not
to be unfrequent, but I have never personally witnessed them ; they
are probably dependent in some way upon the dragging of folds of
peritoneum on the duodenum as above described, for the idea that
there is ever direct pressure of the kidney upon the bile-ducts is not
borne out by anatomical investigation, except possibly in such a
case as Lindner's (p. 126), in which a floating kidney with stones in
the pelvis pushed against the gall-bladder and gave the appearance of
a tumour of the gall-bladder, but in that case there was no jaundice.
Litten (*Char. Annalen*, 1880, p. 93) observed in a woman, aged
thirty-seven, with a right floating kidney, frequent pain in the
right hypochondrium with temporary intense jaundice twice
in a fortnight, lasting four days and eight days respectively, and
he attributed it to temporary compression of the bile-ducts by the
kidney. Landau refutes the possibility of this on anatomical
grounds, and Lindner quotes a case in support of Landau in a
woman, aged forty-one, in which on abdominal section it was
proved that neither the kidney nor its pedicle came anywhere near
the biliary ducts and that their compression was impossible. Autopsy
supports Landau's theory: a right floating kidney, if carefully
drawn forwards or downwards, causes traction on the duodenum
at a point 2 to 3 cm. below the junction of the biliary ducts,
and though it does not occlude the lumen it interferes with the con-
tents of the bowel sufficiently to impair digestion and cause biliary

obstruction. Symptoms of chronic appendicitis are considered by Edebohls to be a very frequent complication of movable kidney on the right side, and he explains this on the supposition that the misplaced organ produces an indirect pressure upon the superior mesenteric vessels, which become compressed between the pancreas and the bodies of the vertebræ, and thus a chronic congestion of the appendix and colon is produced which is sufficient in the case of the appendix to give rise to definite symptoms.

Venous obstruction.—In other cases signs of venous obstruction show themselves by œdema of one leg; and thrombosis of the vena cava due to this cause has also been recorded.

Urinary symptoms.—In most uncomplicated cases the urine is healthy and is as a rule voided in the normal way; in many cases there is some albuminuria from time to time, but if the urine is habitually albuminous the albumen will be due to some pre-existing or co-existing independent disease. Still there are cases, not so very few, in which urinary symptoms are complained of. Küttner speaks of frequent straining in order to urinate, and of slight polyuria. Apolant draws special attention, in the case of a woman, aged fifty, with very serious abdominal disturbance due to a floating kidney, to a symptom which had been overlooked, namely, *excessive polyuria.* I have operated upon several cases in which slight pyuria or hæmaturia and frequent ardent desire to micturate were symptoms in movable kidney.

Renal paroxysms.—Cases of movable kidney are occasionally apt to give rise to very acute symptoms after some severe or unusual exertion. These attacks are quite sudden and are characterised by acute abdominal pain, hardening of the abdominal wall—uniformly, or locally, especially on the affected side—faintness, giddiness, and other symptoms of collapse, or even death from shock; during these attacks the kidney can often be felt enlarged from congestion and renal retention of urine, and is extremely tender. The urine becomes scanty and may contain albumen, casts, or even blood, but again becomes normal when the attack passes off, and then polyuria sometimes follows, as it may do after any severe nervous shock. These symptoms are probably due to some displacement of the kidney produced by the exertion, and to the organ becoming

compressed possibly between the last rib and the vertebral column (Gilewski). Acute hydro-nephrosis is sometimes thus produced, although the cavity of the kidney in these cases may be far too small to cause an appreciable tumour.

This acute condition [*] has been long known, and has received the name of "renal incarceration" from its analogy to cases of strangulated hernia; but Bruce Clarke,[†] who recorded some cases in 1893, proposed to revert to the term "acute renal dislocation," used by the ancient writers,[‡] who considered the condition more allied to the displacement of the head of a bone than to a strangulated hernia. Another explanation of these acute attacks is that they are due to torsion of the renal vessels from rotation of the kidney, and Newman has recorded cases of transitory hydro-nephrosis accompanied by acute pain with casts and albumen in the urine, in which torsion of the vessels was verified by operation.[§] Newman also records a case in which the symptoms of uræmia usually appeared suddenly when the kidney was displaced, and disappeared in from twenty to forty-six hours: oliguria or anuria, severe pain in the renal regions, sickness, nausea, vomiting, dimness of sight, severe and persistent headache and lethargy, with occasional paroxysms of excitement, were the symptoms.

In many cases the kidney may become permanently hydro-nephrotic, and this may happen either through a permanent kink in the ureter or through an obstruction at its origin in the renal pelvis. Temporary hydro-nephrosis may also result from a frequently recurring curvature or twist of the ureter, or a curvature rendered permanent by secondary adhesions; but the obstruction must be either intermittent or incomplete for hydro-nephrosis to be caused. Obstruction often arises secondarily to some dilatation of the pelvis, for as the sac dilates, the orifice of the ureter is considerably modified, and often opens so obliquely in the wall of the sac that no free flow of urine can possibly take place; while in other cases an unequal dilatation of the renal pelvis causes a valvular fold to project over the mouth -of the

* Morris's "Surgical Diseases of the Kidney," 1885, pp. 42 and 311, 312 and 313; and Morris's Cavendish Lecture, 1893.

† *Roy. Med. and Chirurg. Trans.*, 1893.

‡ *See* Lancereaux, art. "Rein," *Dict. Sciences Méd.* 1876, and "Leçons de Clinique Médicale," Paris, 1894. *See* also Landau.

Clin. Soc., 1896.

ureter (*see* Part II., Vol. II., Chapter IX., on Stricture of the Ureter). These hydro-nephrotic conditions may exist for a long time without its being possible to detect them, but the weight of a hydro-nephrotic kidney usually increases the sense of dragging and many other of the subjective symptoms. If the flow of urine becomes completely stopped by a twist in the ureter, atrophy of the kidney will be the result.

There is no doubt that movable kidney like many other causes of physical suffering, slight as well as severe, may lead to the development of hysteria in a girl or woman who had previously shown no signs of any such neuropathic tendency, and that this may be completely cured by nephropexy. There are other individuals of a neurotic temperament who have shown signs of hysteria before the kidney has been known to be movable and whose condition is aggravated by the knowledge. But hysteria and neurosis are not by any means invariable accompaniments of movable kidney. Some of the most painful cases, which are slowly developed after a slight injury, and still many more that occur without any assignable cause, are met with in healthy, physically and mentally active women, who are completely invalided against their will by the pain and digestive troubles caused by the nephroptosis. Though the patients have perseveringly, but in vain, tried belts, diet, and prolonged recumbency, they obtain the most complete and gratifying results from fixation by operation. During the course of the disease the general health of the patient is naturally much impaired ; languor, debility, loss of flesh, hypochondriasis, great restlessness, great anxiety, hysteria, perversions of sensation or of the special senses, and many other neurotic signs are, some or other of them, commonly present. In the female, pregnancy and the menstrual periods are usually occasions of increased suffering ; in males and females alike constipation and impaction of hardened fæces in the colon add to the patient's distress.

To repeat, in a few words : the **subjective symptoms** excited by a movable kidney are usually of three types : (1) *pain*, with occasional crises of severe suffering, amounting sometimes to great agony, and a pretty constant sense of weight and sometimes of movement in the abdomen ; with aching in the back and side, and a sense of dragging weight in the loins ; (2) *troubles of digestion*, such as nausea, flatulence, sickness, loss of appetite, and other symptoms

of dyspepsia and irregularity of the bowels; (3) symptoms of *neurasthenia* and *hysteria*; (4) occasionally but comparatively rarely there is some change in the urine or in the functions of the urinary organs generally; (5) more rarely still some complication due to mechanical compression or dragging, such as intestinal obstruction, jaundice, or great gastric dilatation, or, finally, enteroptosis.

The **physical signs,** when any such exist, are the presence of a movable tumour of characteristic renal outline, which on palpation is painful, or gives rise to a peculiar sickening sensation. The movement may be slight or considerable. When the kidney is movable in a " cinder-sifting " manner there may be no movement detected by palpation. I have on several occasions operated where the symptoms have been marked, but the mobility was only actually detected after the kidney had been explored through the loin. In thick-set persons or persons inclined to be. stout there may be a wide range of movement of this kind unrecognisable by bimanual palpation. In other cases of great mobility, either of the " movable " or " floating " type, there are times when the kidney cannot be felt or made to move. Küttner points out the importance of more than one examination where movable kidney is suspected, and I am always careful never to declare that a kidney is not movable because I cannot feel it move, if any trustworthy observer has pronounced it to be movable.* I have sometimes reduced a " floating " kidney, and nothing that I could do at the same examination would make it come down again, yet the next day it has been as freely floating as ever; on the other hand, a woman, thirty-seven years of age, was able with her right hand to bring a movable right kidney out of the right hypochondrium into the umbilical region without any pain, and so that it could easily be grasped through the flabby abdominal walls (Armin).

In several cases the kidney could be pushed upwards under the ribs, downwards into the pelvis, and inwards across the median line. When the mobility is considerable, the abdominal parietes, which are sometimes very flaccid, permit of the tumour being quite grasped by the fingers of the surgeon; the tumour will be found to fall below the margin of the ribs

---

* *See* author's Cavendish Lecture, 1893, for typical cases.

and towards the umbilicus or the pelvis when the patient sits or stands; to roll from side to side according to the inclination of the body; and to be easily pushed back into the loin when the recumbent posture is resumed.

A "floating" kidney does not generally fall spontaneously into the loin whilst the patient lies on her back, but, on the contrary, has a tendency to rise forwards and towards the median line as soon as the pressure which has thrust it backwards is removed. Respiratory movements as well as the position of the body influence the position of the kidney; deep inspiration forces it downwards, forcible expiration allows it to ascend. When the degree of mobility is but slight, only a small part of the kidney may be tangible, and that only on deep inspiration; when moderate, half or three-quarters of the organ will be felt between the margin of the thorax and the umbilicus. The tumour gives a sensation of smoothness and firmness with its extremities rounded. *The direction of its long axis is not by any means always the same, but is frequently oblique from above downwards and inwards.* Percussion over the tumour gives usually a tympanitic sound, or, as Roberts styles it, " a muffled tympanitic note," owing to the pressure of some coil of bowel between it and the parietes. Percussion over the vacated loin elicits a more or less distinctly resonant note; and there is a sense of deficient resistance in the ilio-costal space. These signs are lost, however, as soon as the kidney is thrust back into its proper position.

Occasionally there is no recess in the loin to indicate the place vacated by the kidney; on the contrary, fat sometimes accumulates there and shapes itself to the under surface of the liver or spleen, as the case may be. The right lobe of the liver, when enlarged or displaced by tight lacing, may effectually keep the kidney out of the loin.* In a case recorded by Dr. Tuckwell the right kidney fell back by its own weight into its proper position as soon as the liver was removed.

I have previously described (p. 84 *et seq.*) the best way of making the examination of the kidney by palpation. The method of Rayer,

* *See* a paper by the author "On the Clinical Confusion between Distension of the Gall-bladder and Movable Kidney," *Brit. Med. Journ.*, February 2, 1895.

Jenner, and Freund was to place one hand below the costal margin
behind, and press forwards whilst the other hand compresses the
tumour from the front. Some surgeons prefer the methods of
Glénard, or Israel, or of Guyon. But there is no reason why all
of them should not be employed.

By palpation one can not only make out that the kidney
moves too freely, but also whether it rotates or moves upwards
and downwards, or inwards. In many cases if an attentive manipu-
lation is employed the kidney will be detected rotating on its own
transverse axis so that the hilum comes to look upwards and
inwards; occasionally, but much more rarely, the hilum is turned
downwards and inwards. When the patient is rolled over on to
the sound side the convex border of the kidney can sometimes
be felt to tilt inwards towards the median line, so that the posterior
surface has a slight outward inclination. Again, the upper pole of the
kidney in exceptional cases can be detected nearer to the anterior
abdominal wall than the lower pole, having the form of displace-
ment described first by Potain as " anteversion," a form of movable
kidney which he says is generally mistaken for hepatic or pyloric
tumour. Again, the size and shape can sometimes be made out,
although owing to the increase caused by fluxional hyperæmia,
it is easy to be deceived as to the size of the organ, by feeling
it through the abdominal parietes. Sometimes the organ is more
or less deformed by adhesions, flexion on its own axis, or after
the failure of a previous nephropexy.

In exceptional cases the tumour may occupy the iliac fossa ;
and. there may be great displacement without the kidney being
at all felt through the abdominal parietes, as, for example, when
the organ is overlaid by an enlarged and displaced liver or falls
behind an enlarged uterus. The pulsation of the renal artery
has been observed by some writers ; epigastric (forcible aortic)
pulsation, and congestive enlargement of the movable kidney, are
very common.

Diagnosis.—It must be said at once that in no case can
we be justified in concluding that a patient's sufferings are due
to a movable kidney unless we can actually feel the kidney to
be unduly movable. Even then, though all the typical symptoms
may be described and complained of, we must not decide that
the movable kidney is the cause of them until we have made

a careful investigation of the other organs of the abdomen and pelvis, and of the way in which their functions are discharged. So frequently are symptoms which are caused by the kidney referred to some other organ, so varied are the nervous and other disorders associated with the female genital organs, that it is often most difficult to say how much of the neurasthenic symptoms, how much of the abdominal pain and backache, how much of the gastro-enteric disorder, or how much of the disturbed urinary functions is due to the movable kidney and how much to some other morbid condition, or indeed to a hysterical temperament. The neurotic element especially makes the diagnosis always difficult and the result of nephropexy or any other form of treatment uncertain. Tuffier recorded the case of a woman with movable kidney complicated by intercostal neuralgia on the same side (" Congrès français de Chirurgie," 1880). In cases in which one-sided pain, occasional renal crises, and some amount of gastro-intestinal disorder occur, with perhaps a little pus or blood occasionally in the urine, and frequent or painful micturition, but no physical signs of mobility of the kidney, the diagnosis must be left until the kidney is explored. Stone, hydro-nephrosis without a palpable tumour, or ureteral stenosis or valve may cause the same group of symptoms, but so also does the " cinder-sifting," " movable " kidney. It matters not therapeutically that we cannot make a diagnosis, for the condition can be ascertained by lumbar exploration, and corrected by the appropriate operation, and, what is more important, cannot be cured by any other means. This " cinder-sifting " form of movable kidney is one of the renal affections which are capable of· being readily remedied by surgical means, but which must go undetected until the lesion has far advanced and the kidney in great part destroyed, if physicians and practitioners lean implicitly upon the results of the Röntgen rays as the test of the presence or absence of renal calculi. Such remediable renal affections are often discovered unexpectedly in the search for a renal calculus which does not exist.

The diagnosis between a " movable " or " floating " kidney and a movable abdominal tumour is usually sufficiently easy, although there are numerous instances of mistakes made by most capable clinicians. A " floating " kidney has been sometimes diagnosed as something else, but what in my experience happens

far more frequently is that some other movable tumour is diagnosed as a movable kidney. Probably the commonest error is to mistake an enlarged gall-bladder for a "floating" kidney; but even a movable right lobe of the liver has been regarded as a floating kidney when felt through rigid or fat abdominal parietes; and cases are on record, and others must have come under the notice of most surgeons who see much of renal practice, in which a movable spleen, cancer of the cæcum,* cancer of the stomach (Edward Apolant), tongue-shaped lobe of the liver, an intraperitoneal abscess, an ovarian cyst or dermoid (Smith, quoted by Frank), a uterine myoma and tumours of the omentum or mesentery have been mistaken for a floating kidney, or *vice versâ*. Smith's case is noteworthy because nephrorrhaphy was successfully performed from the peritoneal side in the course of an exploratory laparotomy performed on account of the uncertainty of diagnosis between an ovarian tumour and a floating kidney. It is between floating kidneys with or without a mesonephron and other tumours that most of the errors are made. The cinder-sifting movements of the "movable" kidney, confined as the organ is behind the peritoneum to contact with the lumbar parietes, is not likely to be mistaken for the tumours having a more central or anterior position or which can be moved in many directions. For the movable, deformed lobe of the liver and for malignant disease of the cæcum the right "movable" kidney may be mistaken, whilst the left is sometimes mistaken for the spleen, or the spleen for it.

In examining any tumour of the abdomen the possibility of its being a movable or floating kidney should always be remembered. Small ovarian dermoids and pedunculated uterine myomata are diagnosed by the position of the attachment of their pedicle, and by moving in an arc whose centre is below and not in the hypochondrium, and by paying attention to the history. They cannot be reduced entirely into the loin behind the ribs, unless their pedicles are very long, and they will in most cases be felt by vaginal and rectal examination when crowded downwards into the true pelvis.

"It is only a small ovarian tumour with a long pedicle which

* *See* cases by the author in the *Lancet*, April 27, 1895, p. 1047, and also a case by E. Owen, *Lancet* Vol. I., 1895, p. 1054.

can be mistaken for a floating or movable kidney. The latter may be recognised by its characteristic shape, though it is often so misplaced that the hilus is turned upwards. The kidney is usually felt between the umbilicus and the false ribs, and may be pushed upwards and downwards, or laterally, to a varying extent, or into the lumbar region to the normal position of the kidney. When the kidney is pushed away from this position the sound on percussion becomes tympanitic."*

I have removed a small parovarian cyst holding about eighteen to twenty ounces of fluid, which varied its position ; some days it could be made out from the front of the abdomen, sometimes not ; the percussion note over it was always resonant, but a swelling could always be felt *per vaginam* on one side (left) of and to the back of the uterus, and the direction of disappearance of the swelling was always downwards into the pelvis. The tumour had not increased appreciably in size, but it gave rise to frequent sickening pain. The absence of the renal outline, the low position, the pelvic connection of the tumour, and the fact that the tumour could not be pressed upwards or inwards, and more especially not towards the loin, excluded the possibility of its being a kidney, though the shifting position, the invariable resonance over its front surface, the sickening pain excited by pressure, and the want of increase in its size, might have led to confusion but for rectal and vaginal examination.

An ovarian tumour with a long pedicle would have more liberty of movement than a parovarian cyst, but its preference for the pelvis and its resistance to being forced into the loin when pressed upon, as well as its shape, its tendency to increase in size, and most probably the absence of resonance on percussion over it, would serve to indicate its nature and to contra-indicate a movable kidney.

A *distended gall-bladder* is not unfrequently confused with a movable kidney. Sometimes the two conditions co-exist and then usually one is diagnosed and the other overlooked, and indeed I have seen both present in the same person so many times that I have come to the conclusion that there is in some instances a causal relationship between them. On comparing the two conditions we find these facts :

* Spencer Wells, *Dublin Quarterly Journ. of Med. Science*, Feb.–May, 1867, p. 140.

(1) That movable kidney and enlarged gall-bladder are each much more frequently met with in women than in men.

(2) The right kidney is many times more frequently movable than the left.

(3) Movable kidney and enlarged gall-bladder often occur in the same person.

The probable explanation of the frequent occurrence of the two conditions in the same person is that they are due to tight lacing, which, while it causes displacement and mobility of the kidney, also causes displacement of the liver, kinking of the gall-ducts and formation of gall-stones as a result of the obstruction to the flow of bile. Moreover, the two conditions tend to produce each other, for while downward pressure of the liver induces mobility of the kidney, the latter in its turn drags on the duodenum and bile-ducts and so tends to obstruct their channels.

In considering how we can diagnose the one class of cases from the other, the first and most important thing to bear in mind is that the enlarged gall-bladder as well as the kidney is a frequent cause of *movable* abdominal tumour. This is far from being sufficiently recognised. The second is, always to inquire if there has been a distinct attack of jaundice. The third is that the tumour caused by an enlarged gall-bladder can in almost all cases at all times be felt, whereas a movable kidney (unless also enlarged or ectopic) cannot. The latter is sometimes easily detected, at others not at all. An enlarged gall-bladder is always easily felt by pressure on the front of the abdomen. Fourthly, the fact that the size of the tumour varies from time to time goes for nothing in the diagnosis, unless it is clear that with the diminution of the swelling there invariably follows a marked increase in the quantity of urine voided.

Movable kidneys are frequently of smaller size than normal, and are often degenerated in texture as well as diminutive in size ; but for all that they have a tendency to swell from vascular turgescence, or, if hydronephrotic, from accumulation of urine ; owing to their shifting position they are also more palpable at one time than at another. A distended gall-bladder also will vary in size if the cystic duct is blocked by a calculus which from time to time slips back into the gall-bladder, and thus opens the channel

for the escape of the pent-up bile or mucus. But with few exceptions there is always evidence of some swelling as long as the cause of the obstruction remains unremoved. Fifthly, a gall-bladder with calculi feels much harder than a movable kidney.

A sixth feature is the range and character of the mobility. However free the movements of a gall-bladder, they take place in the arc of a circle the centre of which is a point beneath the edge of the right lobe of the liver. Around this point the free or lower extremity can be moved to the left and to the right of a vertical line drawn through the axis of the swelling, and further in the direction towards the left than towards the right. It can be pushed upwards and it can be also pushed backwards; but unless the liver as a whole is unduly mobile (and the whole liver is sometimes movable to a very remarkable extent) the gall-bladder cannot be pushed downwards towards the pelvis, though it descends a little on deep inspiration.

The kidney, on the other hand, moves bodily from place to place within the limits of its loose connections; it will go up or down or inwards towards the median line or beyond it, and it has a special tendency to slip, like a greasy mass, beneath the finger tips upwards and backwards, into its normal position— unless prevented from doing so by the pressure of the other hand on the abdominal wall above it. The kidney, in other words, has a tendency to spring back into its proper position in the loin; whereas the enlarged gall-bladder, though it can, in many cases, be pushed so far back into the loin that its free end can be readily felt in the ilio-costal space behind, has the tendency to spring back again to its position in the front of the abdomen.

In presence of a distended gall-bladder it is generally possible to grasp the kidney, or at any rate its lower extremity, between the two hands by pushing the tumour forwards and towards the median line with the back of the finger tips of the right hand, and at the same time pressing forwards the loin with the fingers of the left hand in the manner described on p. 84. In this way the two organs are separately distinguished at the same moment. The kidney may likewise be thus found to move independently of the tumour formed by the gall-bladder. This can often best be accomplished with the patient lying on the left side.

In the descriptions of the symptoms of movable kidney too much stress is apt to be laid upon an undue hollowness and resonance, with diminished resistance, in the loin. These are very unreliable symptoms because (1) in some positions of the trunk and thighs there is much hollowness in the ilio-costal space when the kidney is in its proper place ; (2) the mass of muscle and fat in this region often prevents a tympanitic note being elicited when the kidney is displaced ; and (3) the natural position of the kidney is so much under cover of the lower part of the thorax that hollowness of the loin and resistance in the ilio-costal space have no bearing upon it naturally.

Another diagnostic feature to which too much importance has been attached is the relation of the colon to the tumour. Normally the colon is on the outer side of the right kidney and the transverse colon below and behind the gall-bladder ; and Ziemssen pointed out that if the gut is inflated with air the kidney is pushed backwards and the gall-bladder upwards. But it is so common for the ascending colon and the hepatic flexure of the colon to be considerably displaced inwards and downwards, especially when either of these affections exists, that the result of inflation is very misleading. The so displaced colon on becoming inflated will push the kidney upwards, just as, in the natural position of the viscera, it does the gall-bladder.

Aspiration of the swelling has sometimes been proposed as a means of diagnosis ; but apart from the danger attaching to this procedure there is the further objection that the character of the fluid withdrawn from a gall-bladder may have none of the characters of bile. In many cases the contents of a distended gall-bladder are of a dropsical nature, very like the fluid of a hydatid cyst ; in other cases it is glairy mucus quite unstained by bile ; and in others again it is pus.

In the doubtful cases an exploratory incision is the only means of positively deciding the diagnosis ; and as this is quite free of risk it should be early resorted to, with full confidence that if the tumour be an enlarged gall-bladder the earlier it is dealt with by operation the better for the patient ; and that if it be a movable kidney nephrorrhaphy will relieve the symptoms and prevent hydronephrotic changes which sooner or later may destroy the kidney.

In a case recorded by Dr. Lindsay Steven, a floating kidney with a fairly perfect mesonephron was found associated with a gall-bladder greatly distended, and with its duct occluded by a large calculus. I have recorded six cases typical of the confusion between enlarged gall-bladder and movable kidney (*Brit. Med. Journ.*, February 2, 1895). Lindner records a case of a woman, aged forty-five, on whom laporatomy was commenced with the intention of removing the gall-bladder; after opening the abdomen, it was found that the distended gall-bladder, forming a hard pear-shaped movable tumour, was pressed upon by a very small floating kidney with several stones in its pelvis. The exploration was abandoned and all pain entirely disappeared.

Apolant gives the case of a nurse, aged fifty, a unipara, who for eighteen years had slight trouble and for three years dyspepsia, vomiting, cephalalgia and increasing emaciation, with a movable right kidney (diagnosed as cancer of the stomach). She passed a gall-stone, but the pain increased afterwards.

There are many patients sent to Carlsbad, as was this one of Apolant, who have both affections, movable kidney and gall-stones, or perhaps dropsy of the gall-bladder; and there are others whose symptoms are all due to movable kidney but are wrongly attributed to some hepatic or cystic lesion.

Cordier has noted six cases in which gall-stones were associated with movable kidney, due, as he attributes, to compression of the common bile-duct. Von Tischendorf (quoted by Frank) took the opportunity of an operation for biliary calculus to perform nephrorrhaphy from the peritoneal side. The operation was quite successful.

The size and outline of the tumour, its ascertainable attachments, its want of tendency to increase, its smooth surface, the sickening pain on pressure, the want of resistance in the loin, especially when the patient is on her hands and knees; and the facility with which the movable kidney can be pressed back into the loin, are the features which will guide to a correct diagnosis. If in a tumour, having the size and general form of a kidney, what corresponds to a hilum can be detected, the diagnosis will be assisted. Though it will sometimes be very difficult to avoid error, we must repeat that the diagnosis will often be readily made if only the possibility of a movable kidney be kept

in view when examining a doubtful or unusual abdominal tumour.

Prognosis.—Movable kidney cannot be said to cause death, however destructive of the comfort and activity of life. In the majority of cases it does not interfere with excellent health or even with comfort. There are cases in which it has undergone a spontaneous cure either by means of adhesions the result of perinephritis or of peritonitis, or after pregnancy, or in consequence of the patient becoming stout. By inflammatory processes it may become fixed in some abnormal position or refixed in its natural fossa, just as it may after pregnancy and in increasing corpulency. Perinephritis, by indurating the fatty capsule, tends to make fast the kidney. There are other cases in which neither the degree of mobility, nor the subjective symptoms it causes, increase ; and again others in which there is a gradual augmentation of the lesion and its ill consequences.

I am disposed to think that in those cases, not a few, where vague abdominal pains and gastro-intestinal disorders, with sometimes more or less neurasthenia, have existed for a long time, often several years, without any ascertainable cause, and then at length one kidney is discovered to be movable, the renal mobility has existed throughout, but in the " cinder-sifting " form, and has gone on increasing till it begins to assume the floating type, and then it is detected at the bedside.

When it has been provoked by some slight injury or has come on without any apparent cause, and one kidney alone is affected, there is no reason to apprehend that either the other kidney or any of the other organs will follow suit. If, on the contrary, some degree of enteroptosis has been present from the onset of the nephroptosis, then we must expect other displacements soon to follow, including that of the opposite kidney ; and with the increase of the nephro-enteroptosis we must expect dyspepsia, chronic or sub-acute gastritis, or gastric dilatation, possibly prolapse of the rectum, or procident uterus, or flaccid reducible hernia and general decline of health. If enteroptosis does not complicate the nephroptosis great benefit or complete cure of the pain and the gastro-intestinal symptoms may be expected from nephropexy, even when there is some mobility of liver or spleen. I have mentioned a case of so-called Glénard's disease on p. 101, in which perfect

immunity from all the symptoms followed the operation. By a coincidence I removed a kidney for calculous pyo-nephrosis in the same week from the husband of this woman, and as I occasionally see one or other of them I know that she has remained quite well since her operation nearly five years ago.

Besides the tendency for the mobility to increase there is also a tendency for the kidney itself to undergo degenerative or inflammatory lesions. Intermittent and simple hydro-nephrosis, due to repetitions of kinking or of curvature of the ureter, intestinal obstruction due to compression of the bowel by the displaced kidney (Kidd and Gilford), jaundice from dragging on the duodenum (Litten, Hale White), chronic appendicitis (Edebohls), and later on, pyelo-nephritis and pyo-nephrosis from septic infection of the dilated renal pelvis, are complications which are occasionally provoked by movable kidney.

Slight chronic pyelitis, from repeated congestion, may give rise to pyuria. The congestion from torsion of the renal vessels may cause slight hæmaturia ; and Schilling speaks of albuminuria in 14 per cent. of the cases of movable kidney. When these consequences of unrelieved mobility of kidney are borne in mind and considered side by side with the safety of nephropexy, there ought to be no hesitation in suitable cases in advising the operation.

The cases which afford the least favourable prognosis are those in which there is a large nervous or hysterical element. It is very difficult in them to say how far the symptoms find an organic basis in the movable kidney, how far the symptoms are magnified by the neurotic temperament, and whether they will not continue after an operation, possibly even as bad as or worse than before.

The occurrence of renal crises makes the prognosis, so far as the kidney is concerned, very unfavourable if no operation be performed. In one case in which these crises were very severe they are said to have caused death from shock (Cordier, quoted by Albarran), but this is probably a unique result.

Treatment.—In many cases the symptoms, if any exist, are so slight that no treatment is requisite. In other cases, in which symptoms are only present after exercise, such as riding on horseback, dancing, long standing, or much walking, such forms of

exertion should be, if possible, avoided. In cases in which symptoms occur even during quietude, exercise will have to be restricted as much as possible, or refrained from entirely, with the hope, a forlorn one however, that cure may follow from keeping the recumbent position for some months. Functional disorders of the bowels, especially constipation, should be corrected ; and anæmia and loss of tone of the muscles should be dealt with by appropriate internal remedies and abdominal massage.

As there is evidence which seems to justify the conclusion that the absorption of the circumrenal fat, whether as part of a general emaciation or not, is one amongst the causes of movable kidney, it has been proposed that the patient, in addition to wearing a belt and pad, should be kept upon a fat-making diet with a view to increasing the natural packing of the kidney. Such treatment, besides the improbability of its succeeding, has the further disadvantage of being likely to increase the digestive troubles, even if it could be tolerated by the system or entertained by the æsthetic sentiments of the sufferer.

Massage.—Massage recommended by Kumpf to be employed in the manner of a tremulous pressure below the kidney, combined with massage of the abdominal walls, with the object of obtaining retraction of the peritoneum, is based upon an erroneous view of the causation of movable kidney, is useless in nephroptosis, however beneficial the abdominal massage may be in giving tonicity to flaccid muscles in enteroptosis or in keeping up their tonicity during recumbency if absolute rest is tried in a case of movable kidney. It could not, moreover, be tolerated in some cases attended by much abdominal pain and tenderness.

Bandages and belts.—Tight lacing must be avoided, and when the muscular parietes of the abdomen are weak and flaccid, as they often are, an abdominal belt or stout, closely-fitting jersey should always be worn to support the parietes. If painful or dyspeptic symptoms are constantly caused by the mobility of the kidney a specially fitted pad and belt might be tried to retain the kidney in its proper place. Varying forms of trusses and bandages have been devised for this purpose, and they require to be modified and adjusted in each case.

A stout bandage, provided with a pad which is worn over the kidney, has in some cases given relief. Care must be taken,

however, never to apply the bandage until the kidney has been reduced into its proper place, and to prevent the bandage or truss from shifting its position, and for this purpose under-straps, or elastic tissue let into the jean or webbing, are useful adjuncts.

Newman employs "a well-fitting abdominal elastic bandage, extending from the line of Poupart's ligament to the level of the sixth or seventh rib. The bandage should be made to fit the body accurately and firmly, without exerting undue pressure at any point. It may be made of one piece, or, what is much better, of strips of elastic bandage sewn together, and united in the middle line in front by means of steel slips, similar to those used to fix stays." Before getting up for the day, the patient should slip upwards over the lower extremities a jersey fitting the abdomen tightly, and outside this an air pad should be applied over the kidney after it has been restored to its place, and the broad elastic bandage should be buckled over the pad. A collapsible air pad, which can be inflated by means of a tube and stop-cock after it has been adjusted to the abdomen, is made for the purpose. With this or such-like ap-pliance some patients are made very comfortable, and are rendered capable of taking really a considerable amount of exercise. Very much depends upon the care with which the belt, or bandage, is applied, and I have known much comfort and an entire freedom from crises from their use during the time the patient was under my daily supervision, and was not allowed to rise until I had myself adjusted the kidney and pad; but as soon as the patient passed out of my care and was left to put on the bandage for herself all her troubles returned. This lady suffered the most severe renal crises I have ever witnessed, and had often to be kept under chloroform for three or four hours at a time. She was quite cured by nephropexy performed in 1889, and has led a very active life up to this day.*

The necessity for this care in reducing the kidney before applying the bandage, and in preventing it from descending below the bandage, is easily understood by remembering that the prin-ciple of treatment is the same as wearing a truss for a hernia; but that there is this great difference in the two conditions—

* *See* Table V., Case 10, of the author's "Hunterian Lectures."

namely, that the patient can tell for herself when she has reduced
the hernia, but not whether the kidney is in place, except by the
pain caused by wearing the pad over it in its unreduced position ;
nor can every patient acquire the knack of reducing the kidney
for herself.

Not a few women, too, find a belt so irksome and uncomfort-
able that they positively refuse to continue wearing it, especially
when they realise that they can never be cured by the treatment,
that though the belt may keep the kidney up in place, it cannot
end in fixing it there, and that to give continuing comfort it
must be worn for life.   The surgeon on his part knows that the
cases which are benefited by belts are just those which give the
best results from nephropexy, and that in the great majority of cases
the cure by operation is permanent and radical.   Under these
circumstances he ought to feel it his duty to put the operation
and the alternative modes of treatment before the patient in
the same way that he does in the case of the radical cure of
hernia, pointing out the risks to the kidney from its remaining
movable, the relief but not cure which may be hoped for from
the bandage, and the prospect of complete cure from and the slight
risks of nephropexy.

Dr. Hare has recorded a case in which the mobility of the
kidney markedly diminished after two pregnancies, probably
owing to the gravid uterus acting as a temporary mechanical
support to retain the kidneys in their places.

Electricity, friction, the shower bath, and cold douches, to
give tone to the flaccid abdominal walls, are other means which
have been resorted to for fixing the kidney in its place.   But
they are not successful.

When the symptoms of so-called strangulation of the kidney
occur, complete repose in the recumbent posture, hot fomenta-
tions to the painful part of the abdomen, and anodynes, especi-
ally morphia injections or suppositories, are indicated.

In a considerable proportion of cases of movable kidney the
symptoms are so constant, disabling, or severe, and so little
relieved by rest and appliances, that some more radical measure is
requisite.   There are two operations which have been employed, viz.
nephrorrhaphy and nephrectomy.   The technique of these opera-
tions is fully described in the chapters devoted to operations on

the kidney (Vol. II., pp. 172–276). An operation should be advised when the symptoms are severe and are not relieved by rest, quietude, and mechanical appliances; when, though relieved by rest in the recumbent position, they occur in persons who cannot maintain this position, either from the circumstances of their life or from their mental inability to endure the restrictions of such a life; and when mechanical appliances cannot be borne, or seem to increase rather than to mitigate the symptoms, and the patient cannot move about gently or even sit without suffering. In cases in which, in spite of palliative treatment, paroxysms of nephritic colic, fainting, sickness, vomiting, and pain radiating far and wide in the course of the branches of the lumbar plexus of nerves occur frequently, the only possibility of relief is surgical operation.

Nephrectomy.—This, the first surgical operation ever adopted for movable or floating kidney (1878), is no longer admissible in the treatment of these lesions. It has given disastrous results: out of thirty cases nine were fatal (Macalister); a terrible mortality for a lesion which is not a cause of death, although one which, if allowed to continue, may cause the destruction of the kidney. It is now universally condemned, thanks to the conservatism practised in renal as in other branches of surgery. It is suitable in certain cases of diseased movable kidney, whether the disease is engrafted on the movable kidney or the mobility is secondary to the disease—*e.g.*, in cases of extreme hydro-nephrosis, in certain cases of pyo-nephrosis, of pyelo-nephritis and of tuberculous kidney and malignant tumours; but under these circumstances it is the disease, not the mobility of the kidney, which determines the selection of the operation.

It may be resorted to after nephrorrhaphy has failed, as it was successfully in Gilmore's patient, but not until after a second, or possibly even a third attempt has been made and failed. Whilst nephropexy repeated more than once on the same kidney does not make nephrectomy any the more dangerous or the less practicable, nephrectomy exposes the patient to possibly fatal danger should the other kidney afterwards become diseased. Hagar gives a case in which, after nephrectomy of the right kidney had been performed, dislocation of the left occurred and a calculus was formed in the left renal pelvis. Nephropexy was performed on the calculous organ, and death occurred from uræmia.

Nephrectomy may also be performed when nephrorrhaphy is out of the question, as in certain cases of misplaced movable kidney, which cannot be pushed back into the loin.   In Polk's unfortunate case the unsymmetrical kidney occupied the iliac region, and, though freely movable in all directions, it could not be moved out of the iliac fossa into the loin, and no fixing apparatus was of any use. In fact, the mobility of the kidney in this case had little to do with the distress suffered ; the symptoms were due to the intimate relationship between the displaced kidney and the left ovary.

Nephropexy has proved to be an operation which is both safe and successful, and it has therefore naturally almost entirely superseded nephrectomy.

Collected statistics show the average mortality to be but slightly over 1 per cent., and my own tables,* giving all the operations of this nature which I had performed up to March, 1898, show fifty-seven cases without a single death.   My results up to the present are ninety-eight operations, with one death from cardiac thrombosis in a stout female whose kidney was incised and explored before being fixed.   Tuffier says that his own statistics show thirty operations with one death from tetanus on the thirtieth day.   Tillmanns performed sixteen operations without death ; success was lasting and complete in six, in four there was no relapse, in two relapse, and in the remaining four the wounds healed by first intention, but no subsequent report of them had been obtained.   Frank records the results in sixteen cases in the Friedrichsain Hospital, Berlin : eight were completely successful, three were too recently done to be included in the successes, of one he had no subsequent information, one died, and three died from other causes between the dates of operation and of Frank's communication (1889).   He collected forty-one published cases (English, French, German, and Italian), together with his own, making fifty-six cases in which the results were known, with two deaths, *i.e.* nearly 4 per cent.

Albarran† has analysed the results in 374 collected cases of nephrorrhaphy from the point of view of the risks of the operation.   There were seven deaths within a period of less than four

* "The Origin and Progress of Renal Surgery " (" Hunt. Lectures," 1898).
† *Traité de Chirurgie*, edited by Le Dentu and Delbet, 1900, c. viii.

months after the operation ; but only four of them were in any way due to the operation, and in three out of the four he says the cause of death was some septic complication which might have been avoided. These figures give a death-rate of rather more than 1 per cent. Tuffier in 1891 reported to the French Congress of Surgeons his results in fourteen operations analysed from the point of view not only of operation risks, but of remote subsequent results ; thirteen recovered, one died. Ten of the patients had been kept in sight for three years, and out of the ten, in nine the kidney was solidly fixed.

From all these statistics taken together, it may be safely said that the operative risks of nephrorrhaphy in all hands are not more than 2 per cent., and that excluding rare and exceptional accidents, such as tetanus and the unexpected causes of deaths which follow any event whatever, surgical or otherwise, the operation in experienced hands is practically without any risk whatever. Nor are the accidents attending or following the operation frequent. In one of my own cases in which the ureter was distorted, displaced, and obscured by adhesions fixing it to the lower pole of the kidney, I divided the ureter unintentionally, united it by Van Hook's method of uretero-ureteral grafting, but subsequently had to remove the kidney ; in another case of extremely hydro-nephrotic kidney which I fixed, hoping to save the kidney, nephrectomy was subsequently performed. I have on four occasions performed nephropexy upon kidneys which had previously had the operation done upon them by other surgeons. I have not had to repeat the operation in any of my own cases, nor have I heard of a second operation having been performed by any other surgeon on any kidney which I have fixed, although I am aware that in a few of the earlier operations by a plan different from the present methods the kidney did not remain completely fixed. In one case—a young woman with ankylosed hip from old tuberculous disease, and extreme lateral curvature— the operation was followed by profuse suppuration, which continued for some weeks, and afterwards by a sinus ; but the patient made a good recovery. Lauenstein speaks of right-sided pleurisy and suppuration of the wound occurring in a case in which he fixed a floating right kidney, but nine months afterwards the patient was known to be quite cured.

The advantages of nephropexy over nephrectomy are so obvious that they perhaps scarcely need to be pointed out. They are the following : (1) The amount of excreting renal tissue remains practically the same after nephropexy ; (2) the possibility of there being only one kidney is a matter of no moment ; (3) the greater mortality of nephrectomy is avoided.

In selecting lumbar nephrectomy for movable kidney the surgeon is bound to be absolutely sure of his diagnosis. If there is the smallest ground for doubt, the abdominal operation would be alone justifiable, because it affords an opportunity of ascertaining the presence of a second kidney and of verifying the nature of the movable tumour before commencing to excise it.

To perform lumbar nephrectomy for what is supposed to be a painful movable kidney, and afterwards to discover that the moving tumour had not been taken away, nor the patient's sufferings relieved, would be as terrible a reflection upon the surgeon as it would be a cruel misfortune for the patient.

Frank mentions as peculiarities following the operation, tenderness on pressure in one case, intermitting hydro-nephrosis in another, gastric symptoms with discomfort and vomiting on pressure being made over the lower pole of the kidney in a third. He also says that pains do not always disappear with fixation, and, *vice versâ*, may disappear without absolute fixation.

Nephropexy for pain.—If the case is correctly diagnosed, if the patient is not the subject of marked hysteria, and if the kidney by the operation is fairly firmly fixed and in such a manner as to permit the free passage along the ureter of the urine, pain will be cured in 90 per cent. of the cases. When the pains do not cease after the kidney has been firmly fixed it is because they are due to some other cause and the diagnosis has not been absolutely correct, as in a case sent to me after nephropexy had been performed without relief of pain, which was subsequently proved to be due to an ulcer of the stomach ; or because there is such a degree of hydro-nephrosis with resulting obliquity of the orifice of the ureter to the renal pelvis that the fixation does not remedy the renal detention, or again, because there is some other condition of the kidney as well as the mobility which required nephrotomy or some other treatment.

Its effect on hyperæmia of the kidney. — Terrillon published a case of nephrorrhaphy for a very freely floating left kidney, hypertrophied (? congested) to four times its natural size and the cause of very violent abdominal pains. The operation completely cured the pains and was followed by the reduction of the kidney to nearly one-half its volume.

The effect on the size and sense of weight of the kidney when the enlargement is due to engorgement is often quite remarkable. This is only what might be expected. The same thing is seen in untwisting and fixing a movable spleen, and in one very striking case, on detaching adhesions of the liver, I saw a rapid subsidence in the size of that organ which had been extensively enlarged by the congestion caused by the adhesions.

Effect of nephropexy on the disorders of the digestive system and on the action of the bowels. — This is often not so satisfactory as the effect in removing pain ; nor can we be surprised at this when it is remembered upon how many social, functional, and organic conditions the gastro-intestinal symptoms are dependent. Flatulent dyspepsia and constipation are the two symptoms of this group which I have most frequently seen persist, but there have been very few patients amongst those I have operated upon and whom I have been able to follow who have not acknowledged appreciable improvement in these respects. Tuffier found that the symptoms of this class had disappeared in half the cases operated upon.

Effect on nervous phenomena. — Tuffier gives the same proportion of successes in reference to the symptoms connected with the nervous system. Albarran from his statistics infers that 36 per cent. received no benefit whatever, and that 14 per cent. were only improved. If my own results are more favourable than these figures show it is because I have as far as possible only operated upon patients who have been the subjects of renal crises, or such disabling pain and discomfort as to materially impair their physical activity, and who before and after the kidney became movable had shown no accentuated signs of a hysterical temperament. Operations upon hysterical patients for the relief of subjective symptoms, even when they are based upon a real ascertained physical basis, are not only apt to fail in giving relief, but too often open avenues of thought which end in fresh complaints or in an aggravation of the original ones.

It undoubtedly happens sometimes that a person is credited with being neurotic and her symptoms are attributed to hysteria because owing to an insufficient investigation of the case a movable kidney (or some other definite physical cause for the symptoms) is overlooked ; but, on the other hand, we must avoid the opposite error of overlooking the hysterical element and attributing all importance to the nephroptosis. To do this is to court failure. Shifler quotes fifteen cases in which hysteria is said to have been developed as a sequel of movable kidney, and Marfan has published a case illustrative of this phenomenon. Albarran, basing his reasoning on the maxim that neurasthenia or hysteria is not developed at will, that a determining cause must act upon a soil already prepared, and that this preparation, as the teaching of the school of Salpétrière has shown, is a direct or indirect hereditary neuropathy, has arrived at the following theory regarding nephroptosis : that movable kidney is a mark of degeneracy in a great number of the persons who possess it ; that these patients often exhibit characteristic signs of neurasthenia or hysteria ; that on a soil so favourable for the hatching of nervous symptoms some slight traumatic or other cause produces the mobility of the kidney, and then comes the development of the symptoms. The movable kidney acts the part of a veritable internal traumatism, and the resulting nervous phenomena ought to be interpreted in the light of traumatic hysteria or traumatic neurasthenia from an internal cause. He sees some similitude between these cases and the cases of *railway brain* or *spine* of the English. He argues that, as it is known that as long as the cause persists the neuropathic or hysterical state is aggravated, we should not hesitate because of the uncertainty of the therapeutic effect to operate upon the movable kidney when the nervous symptoms are very pronounced, if belts or bandages and other palliative means have been found insufficient. It is then necessary, he thinks, to operate, well knowing the speculative nature of the result ; at the same time he considers that every mechanical means should be tried before resorting to operation in this group of cases especially.

There are sceptics who refuse to credit nephropexy with all the good it does. They say that much of the beneficial effect is due to the prolonged rest after the operation, to the regularity

of the mode of living whilst preparing for and after the operation, to the moral effect of an operation on the patient, or to the mere exploratory incision, or the possible undoing of a kink or twist in the ureter in the manipulation of the kidney. It is also argued that " the incision in the renal capsule may relieve tension or divide nerves the subject of lithemic irritation " (H. M. Taylor), and thus cure the symptoms mistakenly attributed to a movable kidney. But these are not real arguments against the operation. As regards the beneficial effect of rest I have had experience which leads me personally to attach next to no value to it, for in several instances in which I have operated with most gratifying results the patients have kept the recumbent position for months, six or nine months, before the operation, without the least improvement from it. As regards the other just mentioned circumstances to which it is suggested the benefit might be due, they one and all tell in favour of operation, as they are all brought into action by the performance of nephropexy.

In the case of a woman, aged forty-seven, operated upon by the late Mr. Henry Thompson of Hull* nephropexy was followed by tetanus; but with our present knowledge of the etiology of that disease we may feel assured that unless the bacillus is communicated through the use of an infected instrument tetanus cannot be caused by any operation on the kidney. All operations, even the simplest operation in surgery, are on the same level in this respect.

The conclusions as to the treatment of movable and floating kidney by nephropexy at which I have arrived are the following. I would, however, preface my statement of them by repeating what I have said above respecting belts and bandages for uncomplicated movable or floating kidney, namely, that I have no great faith in their efficacy, that they increase pain and otherwise do harm if not accurately applied, and that many patients will not submit to wearing them.

1. When movable kidney is associated with enteroptosis no operation should be performed on the kidney unless it is evident that the more serious symptoms are due to the mobile kidney alone, and not until after the trial of a well-fitting abdominal support

* *Lancet*, Jan. 20, 1900, p. 157.

and the careful dietetic and medicinal treatment of gastric and intestinal disorders. Should these means fail and the kidney evidently be mostly at fault, nephropexy, followed by the wearing of an abdominal belt, should be tried.

2. When a movable kidney is complicated by a movable liver, or when both kidneys move, the same rule should be followed as in general enteroptosis ; and in the case of both kidneys moving they should be fixed one after the other at an interval of a week (when both organs have been giving trouble), so that convalescence from both operations may be taking place simultaneously. I have in several instances operated upon both organs, and in all but the one where the ureter of the right kidney was divided (*see* p. 134), with the most satisfactory result.

3. When the movable kidney is complicated with hysteria or neurasthenia all palliative means should be tried before resorting to an operation, and the patient's friends should be informed of the uncertainty of the result from operation. The statistics show that a cure may be hoped for by nephropexy in about half of these cases.

4. For uncomplicated movable or floating kidney in which the principal symptoms are pain and gastro-intestinal troubles the question of operation ought to be placed before the patient, as it is in the case of radical cure for hernia, and the operation may be confidently advised and carried out without any previous trial of belts or rest.

5. When renal crises are a feature of the case, nephropexy ought to be strongly urged, because of the impossibility of keeping the kidney in its proper place by a belt, and of the constant danger of hydro-nephrosis and the recurring pain of moderate renal retention due to kinking of the ureter, even if the renal crises can be kept under control and the more severe degrees of ureteral curvature or twisting can be prevented.

6. When a movable kidney gives rise to no inconvenience an operation ought not to be thought of and a belt need not be worn.

There are several ways of performing nephropexy, each of which is fully described in one of the chapters on operations (Vol. II., p. 220 *et seq.*). One or two points, however, connected with the operation for floating kidney should be touched upon here. In the operation for a floating kidney with a mesonephron the peritoneum has to

be opened in making the lumbar incision, and it may also have to be in the case of floating kidney without a mesonephron. Under these circumstances the kidney should be pushed fully back into the loin, into the posterior angle of the wound, and the serous covering of the kidney should be sutured to the peritoneum of the abdominal wall—this will secure strong adhesions which will hold the kidney firmly in its place.

Rosenberger employed this method in a case of " movable " kidney where he had to tear apart the thick adipose masses which covered the kidney, as well as to divide the peritoneum. Hoffa, who examined Rosenberger's patient some time after the operation, said that the union was much firmer than in Hahn's patients, whom he had also examined, where the kidney had been sutured extra-peritoneally by Hahn's method.

When the liver or the spleen is lower in position than usual, it may happen that the one or the other and not the kidney presents at the bottom of the lumbar wound, and the peritoneum in these cases runs the risk of being opened. No harm ensues if it be. The liver or the spleen, as the case may be, should be pushed well up, and if necessary two or three sutures may be inserted, connecting its peritoneal capsule with the peritoneum of the parietes; then a similar method can be employed to fix the kidney, or the rent in the peritoneum can be closed and the kidney fixed extra-peritoneally. Sometimes the liver is so much pushed down that the kidney occupies the iliac fossa and cannot be brought into the ilio-costal space until the liver has been forced upwards. Such a condition may make it impossible to fix the kidney in its proper place, but it will rarely be found impossible to keep the liver sufficiently well up to enable the kidney to be fixed close up to the lower ribs. I have in one case found this low displacement of the kidney and liver associated with hydrops of the gall-bladder and a calculus in the cystic duct. The calculus was discovered by palpation through the lumbar wound. The patient was turned on to her back, and after removing the calculus and emptying the gall-bladder from the front, I fixed the kidney extra-peritoneally through the loin incision. The operation was followed by an excellent result and the lasting relief of all the symptoms.

CHAPTER V.

INJURIES OF THE KIDNEY.

WOUNDS of the kidney have been described by almost all systematic writers. Celsus pointed out the principal symptoms of injuries to these organs as being " pain extending to the groin and testicle, difficult micturition, and hæmaturia, or the discharge of blood itself along the urethra." A special dissertation on them was published by Gittler* at Leipzig as far back as 1596. Chopart gives a chapter on wounds of the kidney in his " Des Maladies des Voies Urinaires" (Paris, 1791), and cites several instances, four, at least, of recoveries from incised and punctured wounds. A good deal of information on the nature of wounds of the kidney is given by M. Hévin,† in his admirable historical and critical memoir on nephrotomy. Rayer, in his exhaustive classical work, " Traité des Maladies des Reins " (vol. i., 1839), gives excellent general descriptions of the various forms of wounds, contusions, and ruptures of the kidney, as well as brief summaries of the literature of the subject, and the full notes of ten cases of wounds and thirteen cases of contusions and ruptures of the kidney, which he had gathered from the published records up to his time.

Otis, in the second volume (of part ii.) of the surgical portion of the " History of the War of the American Rebellion," published in 1876, collected together a large mass of information from many sources respecting the several kinds of injuries to the kidney, in addition to the reports of cases, fatal and otherwise, which occurred during the course of the war.

Prior to the appearance of this history, Joel Ravel (1870) and Bloch (1873) had published papers or theses on the subject, and since this date, and more especially during the last twelve years, the number of writings and the collection of cases have increased at a rapid rate.

---

* Gittlerus, " De renum vulnere, et qui huic succedit, cruento mictu."
† *Mém. de l'Académie Royale de Chir.*, t. iii., p. 238, fol. ed., 1819.

Injuries which involve the kidneys are of various kinds.   They
may be conveniently considered under the following heads :—

A. Subparietal Injuries of the Kidney, or those in which no
open wound communicates with the injured organ.

B. Incised and Punctured Wounds.

    (*a*) Without prolapse of the kidney.

    (*b*) With prolapse of the injured kidney through an external
wound.

    (*c*) With prolapse of the uninjured kidney through an
external wound.

C. Gun-shot Wounds.

The relative frequency of these several forms of injury in civil
and in military life is suggested by the following records.   It is very
different in the two classes, as might have been expected.   Among
2,610 autopsies on persons dying from all causes at the Middlesex
Hospital between 1873 and 1883, there were thirteen instances of
injury to the kidney, twelve of these being subparietal and one
a penetrating wound.   During fourteen years elapsing between
that time and the present, among 3,040 autopsies, there occurred
only three instances of injury to the kidney, all of which were
subparietal.   In the " History of the War of the American Re-
bellion " only three cases of rupture without external wound are
given by Otis, who says that " but few fatal cases appear in the
reports."   There was no instance whatever reported of incised
or punctured wound.   There were twenty-six cases of recovery
from alleged gun-shot wounds of the kidney, most of them com-
plicated with wounds of other organs or of the ribs ; thirteen
involved the right kidney, and twelve the left ; and there were fifty-
nine cases of fatal gun-shot wounds of the kidney, most of them
complicated with injuries to other viscera and to the spine or ribs.

Edler, in 1887, collected 152 cases from various sources, and
compared the frequency of injury of the kidney with that of the
spleen, his results being as follows :—

	Kidney.	Spleen.
Subcutaneous	90	83
Shot wounds	50	32
Incised and punctured	12	14

Between 1884 and 1893, inclusive, I collected thirty-one cases,
from English and American sources, of injuries of all kinds to

the kidney—lacerations, ruptures, punctured and gun-shot wounds. Of these, twenty-six were *ruptures*, two were gun-shot and three stab wounds. Herzog, in 7,805 post-mortem examinations made at Munich between 1877 and 1889, found seventeen cases of kidney injury, of which sixteen were sub-parietal. Amongst 9,500 surgical patients admitted into St. George's Hospital between the years 1874 and 1879, nine only, *i.e.* one per thousand, were cases of lacerations and contusions of the kidney (Güterbock).

Of the twenty-six cases of rupture in the cases collected by me—

14 died (three owing to simultaneous injuries to other organs).
12 recovered.

Of the three punctured wounds, all recovered.

Of the two gun-shot wounds, one recovered and one died after abdominal nephrectomy : the renal artery and vein had been wounded and the diaphragm perforated, and the bullet lodged against the aorta, the sheath of which was wounded.

In no case was there a rupture of both kidneys.

In a recent publication (1896), Keen of Philadelphia has tabulated 155 cases, not including those of Maas (seventy-one in number), but beginning where Maas left off, namely, in 1878. The analysis is as follows :—

Gun-shot wounds	19
Other penetrating wounds	8
Subparietal rupture	118
Partial nephrectomy for rupture	2
Traumatic hydro-nephrosis	6
Ruptured ureter (pelvis)	2

A. Subparietal Injuries.

As shown by the above-quoted figures, subparietal injuries are by far the most common. They vary much in severity, from the slightest contusion attended with a little hæmaturia, but without any obvious lesion of the renal tissue or pelvis, to complete rupture of the organ into two or more separate parts. They are as a rule unilateral, and only very occasionally bilateral. Three cases have been recorded in which rupture of an unsymmetrical kidney occurred, the other kidney being entirely absent.*

* Cock, *Trans. Path. Soc. Lond.*, vol. i. ; Taylor, *Brit. Med. Journ.*, 1870, vol. ii., p. 485 ; and Johnson, *Montreal Med. Journ.*, 1893–4, vol. xii.

Rupture of the kidney is by no means an unfrequent accident, despite the protected situation of the organ and its envelope of fatty areolar tissue.   Bloch, in 1873, collected forty cases. In 1891 Obalinski made a still larger collection, and finally we have the 118 of Keen's collected from reports published since 1878.

Causes.—The causes of subparietal injuries are generally crushes and direct blows upon the abdomen, loin, and lower part of the thorax, muscular violence, falls from a height, and the forcible flexion of the trunk either antero-posteriorly or laterally.

The passage of wheels (Fig. 23), buffer accidents, shell contusions, the falling in of earth upon the body, the compression of the trunk between two resisting surfaces, such as a wall and the pole of a carriage, or the platform and the footboard of

Fig. 23.—Fissures in right Kidney, caused by cart wheel. (St. Thomas's Hospital Museum.)

a railway carriage, and direct blows upon the loin or upon the iliocostal interspace in front, are the common kinds of accidents which lead to them.   Falls from a height cause injury to the kidney in two ways at least, either by direct violence, the trunk striking against some hard body in the act of falling, or by the sudden and very forcible flexure of the trunk upon itself when the person alights upon the ground.   In some instances the first effect of the violence seems to have been the fracture of one or more ribs, the kidney being wounded by the end of a fractured· rib.

As examples of rupture of the kidney resulting from simple muscular contraction may be cited (1) that of Clement Lucas : a man of sixty-six was walking behind a waggon loaded with sacks, and as one fell he endeavoured to catch it by gripping it suddenly with both hands.   He at once felt violent pain to the left of the umbilicus, and after a short time passed blood in his urine.

(2) That of Campbell, a young girl of fourteen, who doubled

up her body forcibly to the left side in jumping a hedge, and immediately experienced severe pain with collapse and the passage of bloody urine. (3) Londsuth (1761) reported the case of a soldier, who, while boxing with a comrade, was seized with sudden pain and died of rupture of the kidney.

Güterbock (1895), in a review of 985 autopsies held in inquest cases, of which 326 were in persons in whom death resulted from accidents, found thirty-six instances of ruptured kidney, representing 10 per cent of the injuries. His analysis is as follows : —

<div style="text-align:center">

Total number of accidents.
Male -   - 262
Female   64

Number in which the kidney was injured.
Under 10 yrs. of age.   Between 11-70 yrs.
4   26 (total 30)
2   4 (,,   6)

</div>

Fourteen of Güterbock's cases concerned the right kidney, seven the left kidney, and in fourteen both kidneys were damaged.

Tuffier records 198 cases of contusion of the kidney up to 1899. Of these 136 are mentioned as occurring in males, and 17 in females. A rather larger number involved the right than the left organ, and in six only were both kidneys injured.

As regards relative frequency of distribution of these several causes Edler gives the following tabular statement of the ninety cases in his list, including seventy-one collected by Maas.

Crushes	..	..	..	30	Blows..	..	..	9
Falls ..	..	..	..	28	Shell contusions ..	..	4
Run over	..	..	..	13	Unknown ..	..	..	6

It is worthy of notice in connection with the obvious relation of these injuries to dangerous occupations, and other exposure to risk, that of these ninety cases only six occurred in females, and that the ages of the males were chiefly between twenty and forty, that is, in the most active period of life.

The causes of the injury in twenty-two out of twenty-six cases collected by me between 1884 and 1893, were as follows :—

> 18 Falls and kicks—on the loin or corresponding side of the abdomen, chiefly on the loin.
> 4 Run over.
> 4 Not stated.
> ———
> 26 cases.

A man may meet with an accident when intoxicated, and may be unconscious of having received any serious injury or of having met with any accident, as in the case from which the kidney represented in Fig. 24 was taken.

Küster has collected notes of 306 cases, including most of the preceding, up to 1896.

Of 272 in which the particulars are stated, 142 occurred on the right and 118 on the left side, 12 being bilateral.

The ages of the patients were chiefly between ten and forty years, and the influence of sex was very marked, being indicated by the occurrence of subcutaneous renal injury 281 times in males and only 18 times in females, though in the children this was not so decided, there being 33 males to 8 females.

Küster, who does not consider that forcible antero-posterior or lateral bending of the trunk can cause rupture of the kidney, advances other explanation based on experiments on the dead body. He says, " It must, however, not remain unnoticed that Morris was the first to ascribe to the lower ribs a certain share in the production of the injury—as he believes the broken bone may occasionally penetrate the kidney.

Fig. 24.—Deep laceration on the internal surface of left Kidney, which was removed on account of persistent hæmorrhage from an intemperate man, who for five weeks had had a large retro-peritoneal swelling and hæmaturia. (Author's case, reported in the *Clinical Journal*, Aug. 1, 1894.)

" The writings of later German authors, since G. Simon, show that no doubt exists as to the lower ribs playing an important part in causing injury of the kidney. The effects of injuries have been described as direct or indirect (*contrecoup*),

but the mode of laceration of the organ has not been found to correspond to the direction of application of the injuring force.

" The only theory which satisfactorily explains the lacerations of the kidney found after abdominal injuries which do not cause penetrating wounds, is that of hydraulic pressure acting through the full vessels and pelvis, and causing the organ to burst along lines for the most part radiating from the hilus towards the point of maximum impact of the lower rib, the opposing resistance being supplied by the vertebral column.

" Experiments performed on flaccid kidneys thrown with some force against the floor, proved that only superficial grazing or laceration was thus produced.

" On the other hand, when the pelvis and arteries were injected and ligatured after closure of the vein, and the organ then thrown down, there ensued deep laceration of the kidney substance, the chief tear always taking place between the point of impact and the pelvis, which was not unfrequently opened ; other rents had a radiating direction. A most important observation in these experiments was that the edges of the rents were everted, and in one case the pelvic fat was forced *outwards* between the edges of the fissured parenchyma. When the force was applied to the convex border the fissures took a longitudinal direction."

In prosecuting these experiments further on the human body, Küster found that it is easy to push forwards the lower ribs until they touch the kidney, and even force it towards the vertebral column, though on the right side the liver offers some resistance.

" When the kidney was distended with water and a heavy blow delivered on the loin with a mallet, the lower ribs were broken and a superficial graze inflicted on the adjacent part of the kidney, but deep lacerations were produced on both back and front aspects of the organ, their direction being towards the hilus.

" This represents the effect of a blow vertical to the lower ribs, but does not apply to one delivered in front, either by a thrust or fall, but in such a case it is possible, as in the case of sudden muscular effort, that forcible and rapid adduction of the lower ribs takes place as a result of muscular contraction, forcing the kidney against the vertebral column.

"" A sudden force exerted tangentially by the rib against the upper pole may tear or separate it without affecting the rest of the organ ; or a slowly applied force from the front may tear the pedicle or separate the poles without bursting the kidney."

Pathology.—Injuries to the kidney are rarely quite uncomplicated. Either important parts, in relation with the organ, participate in the damage, or remote regions of the body suffer with the kidney when the body is exposed to great violence. Our remarks, however, will be chiefly confined to a consideration of the immediate and remote effects of traumatism on the kidney itself, with its capsule, vessels and duct. The nature of the wound of the kidney varies much. Of twelve cases of subparietal injuries of the kidney, the notes of which are before me, seven were lacerations, *i.e.* partial ruptures, which extended through half the thickness or less of the organ ; two were complete ruptures, the injured kidney being divided into two separate portions ; in the tenth case the kidney was crushed to pieces, almost into a pulp ; in the eleventh, there was simply subcapsular hæmorrhage, that is, blood was extravasated beneath the fibrous capsule of the kidney, but the renal substance was not ruptured ; and in the twelfth there was blood in the pelvis of the kidney, but no rupture, and the source of the bleeding could not be found. In this last case the abdomen had been run over by a carriage, and death was caused by laceration of the liver.

In quite the majority of cases blood in considerable quantity was extravasated into the circumrenal cellular tissue. This would be expected as a matter of course in cases of complete rupture, or when the kidney is very much crushed, but it is also found in cases where there is no laceration whatever of the renal substance. Thus in a case in which blood was effused between the capsule and the cortex of the kidney, and in another in which the only change in the kidney was the presence of a little blood in the renal pelvis, there was a considerable amount of blood extravasated in the cellular tissue around the kidney.

1. *Tearing of outer fat capsule.*—This may occur with or without injury to the kidney. It is usually marked by an effusion of blood, either infiltrating the fibro-adipose tissue, or forming a distinct collection in some part of it, perhaps entirely enclosing the gland. The hæmatoma so formed is not usually

very extensive, and for the most part subsides rapidly, the blood separating into a clear serous fluid tinged with yellow or brown from the detritus of the coagulum.   In rare cases such a collection remains as a cyst, with clear fluid and sediment derived in the same way, which may subside slowly or remain chronic.

The *peritoneum* may be torn, and thus blood or urine may escape into the peritoneal cavity.   This is much more likely to happen in children than adults.   Before the eighth or tenth year the perinephric fat is not developed, and the peritoneum is separated from the front surface of the kidney only by means of the anterior layer of the perinephric fascia.   If therefore the anterior surface of the kidney of a child under ten is ruptured the peritoneum is nearly sure to suffer also.   This adds greatly to the mortality, not only because of the liability to septic infection and fatal peritonitis when blood or urine have been poured into the peritoneal cavity, but because also of the greater freedom of hæmorrhage through the rent of the peritoneum than into the resisting perinephric tissue when the peritoneum is intact.   Death occurred in six cases out of seven in children under ten in Maas's list of seventy-one cases.

2. *Separation of fibrous capsule.* **Subcapsular hæmorrhage.**— Blood may be extravasated beneath the fibrous capsule or into the pelvis of the kidney without any laceration or rupture of the substance, and the pressure so excited may suffice to cause continued pain and interference with function.   Every surgeon who has operated often upon the kidney must have witnessed the occurrence of blood extravasated between the parenchyma and the capsule of the kidney in the course of the manipulations requisite for isolating the kidney before bringing it out upon the surface of the loin, but in rare cases a subcapsular extravasation occurs as the result of some strain or muscular effort leading to sudden pain and other symptoms which are not relieved until the blood is let out by division of the fibrous capsule.   In the two cases, of which brief reports are subjoined, the symptoms were very severe and persisting, and gave rise to the opinion that a renal calculus was possibly present and acting as the irritant to the kidney.   In one case fever, rigors, and delirium with renal pain were the leading symptoms, but there was no hæmaturia.   In the other case hæmaturia and pain, with shivering at the outset and

occasional rise of temperature subsequently, were noticeable. In both cases the condition was observed as soon as the kidney was exposed and before any attempt was made to enucleate the organ from its connections. In the elder woman the kidney was movable and was extruded through the lumbar wound without the need of more than the slightest manipulation.

In the first case there was a subcapsular extravasation of blood whereby the greater part of the fibrous capsule of the kidney had been detached. It is a very remarkable illustration of the severe symptoms which may be caused by this form of injury, and so far as I know it is in this respect quite unique. A lady, aged sixty-six, was taken ill on September 4th, 1893, with severe pain in the left loin, fever, and rigors, symptoms which were attributed to the presence of a renal calculus, and which were subsequently stated to have followed a strain in lifting down a heavy box from a high shelf on the previous day. The symptoms continued unabated for eleven days, when the fever and rigors ceased ; but pain and tenderness in the renal region persisted and were accompanied by sleeplessness and delirium. The pain radiated along the course of the left ureter. On one or two occasions some gravel was passed ; and there was undue frequency of micturition.

These symptoms continued and were accompanied by wasting and sallowness, so it was decided to explore the left kidney.

On October 15th I made an incision in the left ilio-costal space and the kidney was readily and at once exposed. It was but loosely held by its connections, and with the greatest ease was brought out on to the surface of the loin. On pressure between the finger and thumb the kidney yielded a crackling sensation over its whole surface, similar to that produced by cutaneous emphysema. A small incision was made through the capsule of the kidney and at once two or three teaspoonfuls of bright blood escaped and left the renal capsule loose and flaccid on the renal tissue.

No calculus was felt in the substance or pelvis of the kidney or upper part of the ureter, and I did not think it necessary to cut into the substance of the kidney, as I invariably do when exploring for calculus. There was no rise of temperature above 99·8 after the operation. The stitches were removed on the

seventh and ninth days, the wound being quite healed by October 24th. The secretion of urine was scanty for some days, but recovery was speedy and complete.

In the second case a young married woman, aged twenty-two, was admitted to hospital with a history of sudden acute pain in the loins, radiating to the groins and thighs, which commenced five months previously, accompanied by a shivering fit lasting half an hour, and hæmaturia lasting a few hours only. This occurred after considerable muscular effort in the course of house-work. She remained in bed six weeks and then on attempting to get up experienced renewal of the pain and hæmaturia, which subsided when she returned to bed. This experience was repeated with each of several attempts to resume her duties. Three weeks before admission attacks of pain, sharp and shooting in character, but sometimes dull and dragging, began to occur at night.

There was unusual frequency of micturition throughout, the bladder being emptied eight or nine times a day, and three or four times at night. The pain affected the dependent side when lying, the left more severely. One attack of pain and hæmaturia was accompanied by a rise of temperature to 102 F. A dull aching pain in the left side persisted, and the patient appeared somewhat wasted and anæmic, and exhibited tenderness in the loins, especially the left. The urine passed immediately after admission was deeply stained with blood, but was normal on the following day. During the ensuing ten days there was no further manifestation beyond the dull aching pain, worse in the left loin than the right. Nephrotomy was performed on December 14th. On exposing the kidney a dark patch was seen at its lower posterior part having a gritty feel and which on incision proved to be softened kidney substance with effused blood. The incision was carried through the kidney substance into the pelvis in search of a calculus, but nothing of the kind was found. The wounds in the kidney and tissues were then sutured and the patient made an uninterrupted recovery and was discharged three weeks later.

A careful perusal of numerous reports of cases of ruptured kidney leads me to think that in a good number of instances the injury had at first been confined to the parenchyma without further involving the fibrous capsule of the kidney than to detach

it from the parenchyma; and that the capsule had subsequently given way and the parenchyma had become disorganised by the softening effect and the tension caused by the extravasated blood within the capsule. In many cases the blood is extravasated beneath the capsule and between it and the parenchyma, separating the one from the other, just as blood effused from a ruptured middle meningeal artery separates the brain and its membranes from the skull-cap. In other cases the blood is extravasated into the parenchyma, bulging the capsule and encroaching on one or more of the calyces; in other cases again a large branch of the renal artery within the capsule has been ruptured and a traumatic aneurysm has formed, as in cases quoted in an article on "Aneurysm of the Renal Artery," which I published in the *Lancet* in October, 1900 (vol. ii., p. 1002). This form of injury explains the course of many of the symptoms, as, for example, the remissions of hæmaturia, the exacerbations of pain, the irregular pyrexia, the intermittent anuria,* and more frequent and more important than all, the long interval which often elapses between the receipt of injury and the development of a tumour caused by blood or blood and urine in the perinephric tissue.

It is easily understood how the effused blood pent up within the capsule compresses some parts of the parenchyma and engorges the vessels of the rest of the organ so that blood escapes into the calyces or renal pelvis from the congested vessels, even though the rupture is quite superficial. After a time—hours or a day or two—the parts adjust themselves to the pressure, and the pressure is perhaps diminished by partial absorption of some of the blood effused, and then the pain and the hæmaturia cease or are lessened, or the secretion of urine which for a time has been suppressed is resumed again. After a while, from some cause—exercise, a more stimulating diet, straining at stool, some mental disturbance, or what not—fresh hæmorrhage is excited and the symptoms return, until at length the strain upon the softened capsule of the parenchyma causes it to give way, and blood or blood and urine are rapidly effused into the parts around; or without the occurrence of any further hæmorrhage the blood which is already effused beneath the capsule becomes

* *See* Case 8 in Cerou's thesis, *De l'Oligurie et de l'Anurie Traumatique.*

septic and the capsule is perforated or the renal cavity opened
into by ulceration or sloughing.

Many cases might be quoted which, from the course of the
symptoms, and in fatal cases from the results of the autopsies,
lend powerful support to this view.

3. *Laceration of the parenchyma* of the kidney is met with in
every degree of depth, direction, and number of fissures.   Fissures

Fig. 25.—Ruptured Kidney, with numer-   Fig. 26.—Longitudinal rent in Kidney
ous superficial transverse fissures. (St.   of a boy run over by a cart. (St.
Thomas's Hospital Museum, No. 2055.)   Thomas's Hospital Museum, No. 2056.)

may penetrate its substance centripetally from beneath the
capsule, or centrifugally from the calyces, or may completely open
up the latter. Laceration and rupture of the kidney may
take place in any direction, vertically, obliquely, or transversely,
or starred. It is more frequently transverse, or radiating from
the hilum to the convex border, the kidney substance giving
way in the direction of the tubules, not across them.   Some-
times the laceration is superficial, and limited to one surface only.
Sometimes there are several lacerations of different length and depth
(Fig. 25).   When the rupture is complete, one or the other end

of the kidney, may be broken off, or the rupture may run verti-
cally (Fig. 26), or transversely across the centre, extending through
renal substance and pelvis as well (Fig. 27). In one of my cases
the right kidney was ruptured right through its substance, the
rent commencing at its upper border and extending downwards
obliquely to its centre ; there were, besides, two small lacerations
in the lower part of the organ. Assistant-Surgeon Gunn [*] saw
a case in which death had been caused by hæmorrhage from the
right kidney, which had suffered complete longitudinal laceration
by the passage of a waggon wheel.

Sir J. Fayrer [†] found in a Hindoo, who died from tetanus
sixteen days after a fall from a height, an extensive rupture
of the left kidney, running from its upper end to the hilum,
and the areolar tissue surrounding the vessels at their entrance
into the hilum was densely infiltrated with blood. Besides com-
pound injuries to the fore-arms, both liver and spleen were also
ruptured. There was no peritonitis.

A man, aged twenty-nine, who had received a kick in his
back from a horse fifteen years before, without having hæmat-
uria at the time, suffered a few days afterwards severe pain in
the loin, vomiting, and hæmaturia which occurred at intervals.
There was a well-defined, hard, smooth tumour in the right loin
which yielded egg-shell crackling on manipulation. A lumbar
incision exposed a well-defined mass the size of a large orange
involving the lower end of the kidney, calcified, and mistaken at
the time for an ossifying sarcoma. The pedicle was ligatured *en
masse*, and the kidney and tumour removed together. It proved
to be an encapsuled and calcified hæmatoma, with a thin layer
of kidney substance spread over it. The patient died of severe
hæmorrhage and collapse.[‡]

To recapitulate : when the capsule is torn the principal effect
of the injury is an effusion of blood, giving rise to a hæmatoma.
The hæmorrhage is not necessarily extensive, as small vessels in
the parenchyma are alone involved, and there is no effusion
of urine if the uriniferous tubes only are implicated. There
is no tendency for the lips of the fissures to separate, and they

[*] " Med. and Surg. History of War of Rebellion," vol. ii., part ii., p. 20.
[†] Fayrer, " Chir. and Path. Observations in India," p. 591.
[‡] *St. Thomas's Hospital Reports*, 1892, p. 261.

unite readily by primary union, suppuration rarely taking place. Rents may occur both on the anterior and posterior aspects of the kidney, and more rarely at the outer or inner borders : as above stated, they tend to take a radiating direction from the hilum, but may be either oblique or longitudinal.   At the poles fissures are more irregular, and not infrequently sever one or other end completely.

More severe lesions in the centre of the kidney, separating
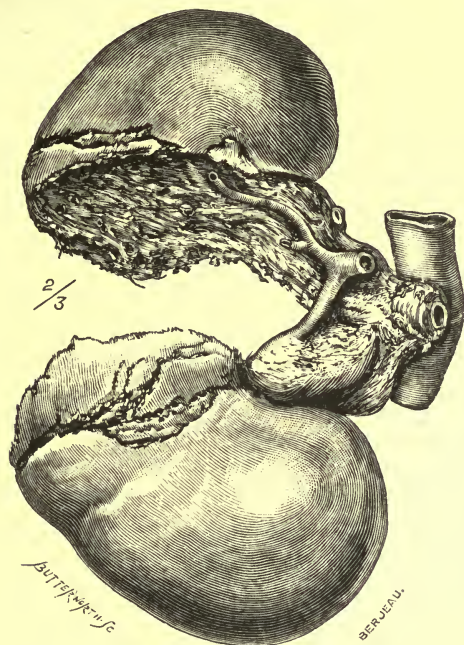
Fig. 27.—Complete transverse laceration.   (Westminster Hospital Museum, No. 790в.)

it into two or more portions, necessarily open the calyces or pelvis, and lead to extravasation of urine.   These will be considered in the next paragraph.

4. *Rupture into the pelvis.*—Deeper rents into the centre of the kidney, often separating it into two or more parts which may remain attached only by the vessels at the hilum, necessarily open the pelvis, and the body of the kidney may even be entirely separated from its pelvis by a cross rent.   When a portion of the kidney is entirely freed from its connections, especially

if the upper or lower extremity of the organ, it may lie at some distance from its normal position. In Page's case (*Clin. Journ.*, Nov. 25, 1896), a boy, aged fifteen, fell from a cart, striking the left side against the kerbstone. There was pain in the loin and vomiting, he was collapsed when seen two hours after, and there was tenderness over the left twelfth rib with hæmaturia. Ergot was administered and an icebag applied. The reaction was febrile and there was renewed vomiting. On the fourth day there was fulness in the left side with pain and tenderness and neuralgia of the last dorsal nerve. The loin was therefore explored, blood-clot and urine were liberated and a rent was discovered in the kidney. The subsequent discharge of urine was copious. On the seventeenth day, owing to the occurrence of blood and pus in the urine and high temperature, the wound was reopened, more blood and urine with pus were released, and the kidney found swollen and, as was thought at the moment, in too septic a condition for removal. This, however, was effected a week later, when it was found nearly divided into two pieces.

It is possible also for damage to occur around a calyx, giving rise to the presence of blood and of kidney fragments in the urine, without anything being apparent on the surface.

In any case of fissure blood is effused into the rent and into the kidney substance in the neighbourhood; but when the large vessels in or near the hilum are lacerated the effusion of blood is rapid and extensive, and the kidney itself may be buried in an enormous blood effusion, which also invades the neighbouring parts. It may separate the layers of the mesentery, extending to the small intestine, and lift forward the colon, or extend to the diaphragm or bony pelvis along the rectum, or distend the flank, causing compression of the important veins in front of the vertebral column. In some cases blood has followed the course of the spermatic vessels along the inguinal canal, causing ecchymosis at the external ring or in the scrotum.

When complete rupture occurs the hæmorrhage is sometimes very great, as in a case recorded in the *Guy's Hospital Reports.**
A young man fell against the edge of a cask whilst deeply intoxicated, and died in twenty-seven hours in a state of collapse; at the autopsy the left kidney was found completely divided transversely

* Second series, vol. ii., p. 424; case 20.

through its middle into an upper and lower half. There was extensive and general extravasation beneath the peritoneal coats of all the viscera, excepting the liver, and an enormous coagulum of blood was found in the left lumbar region, extending from the diaphragm to Poupart's ligament, and also across the spine. The viscera, more especially on the left side of the abdomen, had been raised forward by the effused blood.

When the kidney is completely ruptured and the peritoneum covering it is also torn (an accident likely to occur from very great violence inflicted upon the front of the abdomen) the hæmorrhage may be great and suddenly fatal. In the *Guy's Hospital Reports* * there is the record of a case of a lad, aged eight and a half years, who was suddenly and forcibly struck on the abdomen by the handle of a truck, and died within an hour. At the post-mortem examination the upper extremity of the right kidney was completely torn off, and about a quart of blood was found diffused throughout the cavity of the peritoneum.

In other cases blood is effused behind the peritoneum from ruptured kidney, and into the cavity of the peritoneum from rupture of some other viscus. A man,† aged twenty-four, over whose body a railway carriage probably passed, died five hours after the accident ; on examination, a pint and a half of blood was found poured out behind the peritoneum, and the right kidney was much torn, and cut nearly into two parts ; within the peritoneal cavity were eight ounces of blood, and on the convex surface of the right lobe of the liver was a rent three or four inches in length, and penetrating deep into its structure.

In St. Bartholomew's Hospital Museum there is the right kidney from a lad, aged nineteen, who was crushed by the pole of a van against a wall. Bloody urine was drawn off by the catheter during life. Death took place twelve hours after the accident. The abdomen was found full of blood - clots ; the lower portion of the kidney had been torn off ; the liver was much lacerated ; the tenth rib was fractured.

The most characteristic effect, however, of rupture into the pelvis of the kidney is extravasation of urine. This takes place principally in the neighbourhood of the kidney, forming with

* Second series, vol. ii., p. 485 ; case 21 (1844).
† *Ibid.*, case 22.

the blood a large retro-peritoneal tumour, more especially where a free passage along the ureter is interfered with ; under these circumstances a large cyst may develop with a smooth inner wall containing urine mingled with detritus of blood.

5. *Rupture of renal artery and vein.*—Grawitz records the case of a potter, aged twenty-seven, who fell, striking his right hypochondrium against the sharp edge of a chest. At once violent pain and vomiting were experienced, and there was a dulness in the right side of the abdomen and hæmaturia. The patient died in twenty-four hours. The autopsy revealed a rupture of the right kidney and of the renal artery and vein.

Where a communication is established between the pelvis of the kidney and the lacerated parenchyma or vessels, there is naturally a tendency for the blood to escape with the urine into the bladder. When this occurs the bladder may rapidly become distended with blood, either liquid or clotted, mixed with the secretion from the other kidney.

Thus in the case of a youth of sixteen (recorded by Blum), who fell from an omnibus on to his left shoulder and lumbar region, such a hæmorrhage continued at intervals for over three weeks. The patient was able to rise from the ground after the accident, and after a short rest walked for half an hour to reach home, but hæmaturia with clots occurred immediately and continued with other urgent symptoms, so that nephrotomy and tamponning of the ruptured kidney were resorted to on the third day, and as they proved ineffectual nephrectomy was performed successfully twenty-four days after. The bladder had been in the meantime continually distended with urine, blood and blood-clot, causing intense pain and difficulty in micturition.

In some cases it has been observed that the blood extravasated in the neighbourhood of the kidney remains perfectly fluid for several days. If recovery takes place extravasated blood may remain in great part unabsorbed without giving rise to further local change, as is proved by the case of a man who died eighteen months after he had been kicked by a horse on the right side of the abdomen. Both kidneys were very granular and full of cysts. The cellular tissue around the right kidney was

* *See* Catalogue of St. George's Hospital Museum ; and *Trans. Path. Soc.* vol. xi. p. 140.

consolidated, a large clot of blood occupied the renal cavity, and communicated also with the exterior, where a large quantity of blood-clot was lying in the subperitoneal tissue. The line of rupture could be faintly traced through the substance of the gland. The ureter, where cut across (about one inch and a half from the kidney), was found quite impervious.

This case shows also another important fact, namely, that the ureter and renal pelvis may become quite plugged by extravasated blood, and that in this way the channel from kidney to bladder may be permanently obliterated.

The plugging of the renal pelvis with blood may be the only visible change in the kidney. This was seen in the case of a woman who had been run over, and whose death occurred from rupture of the liver ; the left kidney was nowhere lacerated, but the pelvis was occupied by blood, the source of which could not be detected.

It appears to be in those cases in which blood flows slowly into the pelvis or ureter that the blood is apt to clot there, causing obstruction and subsequent distension and wasting of the kidney.

6. *Laceration of pelvis or vessels at the hilum.*—Without damage to the kidney substance, the organ may be completely detached from the structures at the hilum as a result of continuous severe pressure rather than of sudden violence. The effect of separation from the ureter is extravasation of urine without serious hæmorrhage, giving superficially the appearance of hydro-nephrosis, though investigation shows the kidney itself to be on the confines or at one end of the sac, usually in front.

7. *Total destruction of the kidney.*—In some cases the kidney is found literally " torn to pieces," or the parenchyma reduced to a mere pulp within its capsule, either as the direct result of an injury or of the inflammation to which an injury gives rise. In some of these cases there is little or even no extravasation of blood into the tissue around. Necrosis occurs at once in the separated portions and in those in which the blood-vessels are thrombosed. Hæmorrhage is often .not severe owing to the early occlusion of vessels, and there may be no extravasation of urine, on account of the complete destruction of the secreting structure. The danger to the patient, apart from that due to loss of the kidney (which is considerable when the other organ is diseased, injured or

absent or even temporarily impaired in function), is in the septic and suppurative changes which take place early in the damaged area (Fig. 28) and readily extend to other parts in the neighbourhood or to the other kidney by way of the bladder.

Detachment or thrombosis of vessels, whether of artery or vein or both, necessarily results in necrosis of the kidney, either in part or in its entirety, according to the area cut off from the

Upper end of Kidney.

Torn Ureter

Torn Renal Artery.

Torn Renal Vein.

Lower end of Kidney
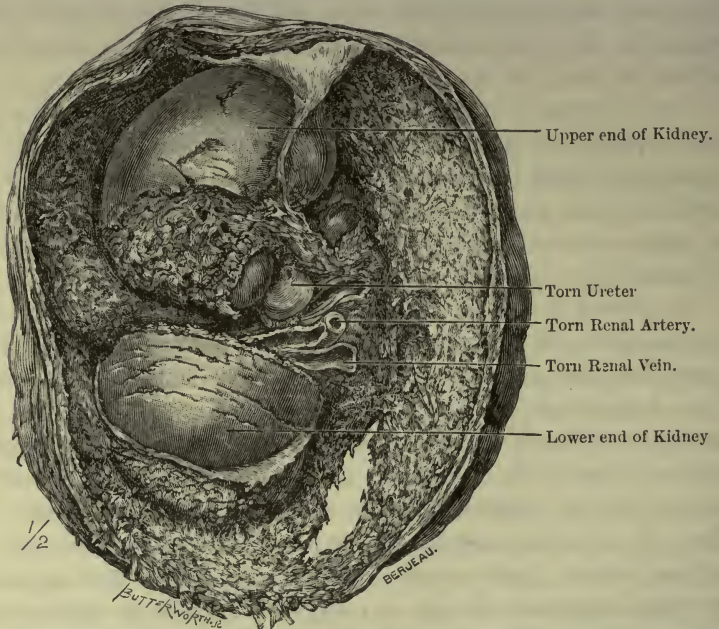
Fig. 28.—Lacerated Kidney and a Perinephric Abscess caused by the buffer of a locomotive.   (Guy's Hospital Museum, No. 1595.)

circulation. When a portion only is affected, one or other pole or wedge-shaped area in the middle presents the several changes occurring in an infarct, with sharply demarcated edges, being first dark and congested and then pale and fibrinous before undergoing necrosis and suppuration, or cicatricial contraction.

When the main artery or vein is thrombosed or divided, mortification attacks the kidney, which separates by suppuration. The degree of hæmorrhage in such cases depends on the nature of the injury to the vessels and on the opportunity of escape of blood into the peritoneum or other large cavity. In some at least the loss has been comparatively trifling.

Pissary and Guinard record an instance of rupture of the renal vein in a man who died thirteen hours after being crushed between two waggons, the force being expended between the left hypochondrium and the right loin. The man suffered from shock and signs of internal hæmorrhage, with severe pain in the right renal region. No urine was passed and no blood escaped. In the collapsed state of the patient only a tentative exploration was ventured upon, disclosing extensive laceration of the omentum; but on post-mortem examination the left renal vein was found torn nearly through its whole circumference several centimetres from the hilum, the effused blood extending to the bifurcation of the aorta and into the left hypochondrium.

The thrombus which forms in the lacerated artery and vein does not extend far towards the main trunk; it is short and is apt to become displaced, giving rise to secondary hæmorrhage. The formation of a traumatic aneurysm is a very rare complication, cases of which will be referred to further on (p. 238 *et seq.*).

8. *Septic infection.*—Septic organisms probably reach the seat of injury from the lower urinary passages, from the colon, or even by way of the circulation; setting up suppurative changes in the effused blood or blood and urine, and the damaged or separated portions of kidney, or giving rise to an abscess, which, as in an observation of Kade, quoted by Küster, may open into the peritoneal cavity. In more favourable cases the pus may escape by the ureter, but in such instances, and in those where clots in the bladder break down, usually in the second week, there is often ascending pyelitis and pyelo-nephritis (bilateral), with death from uræmia.

9. *Associated injuries* may be either independent, or extensions of the local damage, in which the kidney itself is involved. Among the former may be mentioned fracture and dislocation of the spine, fracture of the skull or of the extremities, and such other complications as might be expected to accompany the exposure of the body to the effects of severe force. Rupture of the bladder is usually associated with fracture of the pelvis.

Of the twelve cases of subparietal injuries in my own list, the right kidney alone was involved in eight, the left alone in one only, and in three there were lesions of both kidneys. In ten instances the liver was ruptured as well as the kidney, and in

VOL. I.—L

some of these there was rupture of the spleen, or lungs, or both. as well as of the kidney. Of the ten cases in which the liver was ruptured it was the right kidney alone which suffered in six; and both kidneys in three, the left being most injured in one of the latter. Many recorded cases also show that when the right kidney is injured the liver is very commonly damaged also. The right kidney is, however, sometimes the only organ injured. This was the case in a lad, aged fifteen, who was run over by a cart and died very shortly after from extravasation of blood into the subperitoneal tissue.*

When a fall has been the cause of the injury, fractured ribs, fractured pelvis, or fractured skull may complicate the rupture of viscera. In four out of ten cases in which the liver as well as the kidney was ruptured the ribs were fractured also, and in two other cases there was fracture of the skull.

Despite the protected situation of the kidney, it may be injured in persons of all ages or either sex. Of twelve fatal cases seven were in men, two in women, and in two the sex was not stated.

Among those injuries with which kidney lesions are more closely involved, may be mentioned rupture of the pleura, diaphragm, or lung, accompanied by pneumothorax, and not unfrequently with fracture of the lower ribs. Küster estimates that this latter accident is met with as often as fourteen times in 251 cases of subcutaneous renal injury. The same author mentions fourteen among 251 cases in which rupture of the peritoneum occurred with extravasation of blood or urine or both into its cavity, and points out that this is more liable to occur in children, owing to this membrane being more tightly stretched. The rents were mostly associated with damage to the anterior surface of the kidney, but were sometimes remote from it. The liver, spleen, pancreas, duodenum, and colon are also occasionally injured, especially the first named.

T. H. Manley reported in 1897 an instance of **rupture of a horseshoe kidney** as the result of a kick from a horse in the left lumbo-iliac region, with impact of the patient's back against the corner of a corn-bin. There was immediate collapse with intense pallor, and pain in the abdomen. The first urine was passed sixty-four hours later and

* *See* St. George's Hospital Museum Catalogue.

contained only a few blood corpuscles.   On the sixth day, as feculent vomiting and tympanitis had occurred after getting up during the night, an incision eight inches in length was made along the outer edge of the left rectus and a portion of gangrenous intestine removed.   There was also rupture of the renal substance and probably of one of the veins of the horse-shoe kidney.   Sudden vomiting and hæmorrhage ended the case.

When life is prolonged for some weeks or months, pyo-nephrosis and renal abscess are by no means rare sequelæ of an injury (either contusion or laceration) of the kidney.   Mr. Pollock recorded such a case in his article in the " System of Surgery," * Perinephric abscess and complete tumefaction of the renal substance are also occasional consequences of a blow in the loin. These changes are more likely to follow if a calculus is contained within the injured organ.   I recorded such a case of perinephric abscess in my " Surgical Diseases of the Kidney " (1885), pp. 220, 221 (see Fig. 29). Other sequelæ are chronic nephritis, calculus   or   cyst   formation, and aneurysm of the renal artery.

Fig. 29.—Calculus tightly fitting the Kidney, and leading to Perinephric Abscess after an Injury. (Middlesex Hospital Museum.)

A strain or slight laceration of the renal pelvis may be followed by adhesive inflammation and obliteration of the urinary duct. Hydro-nephrosis may ensue within a few weeks after injury to the renal pelvis, and lead to a tumour in the loin ; and this, after a succession of tappings, may cease to refill, owing to the complete destruction of the secreting substance of the injured kidney.   An   illustrative   case   of   this   sort   is   described   by Croft.†   Stanley's ‡ case was, perhaps, a similar one to Croft's ; or it may have been a case of torn pelvis of kidney ; it was not one of ruptured ureter, as it is so often quoted as being.   In other cases of lacerated pelvis of kidney, the organ in the course

* Holmes, " System of Surgery," vol. i., p. 882 (3rd edition).
† *Trans. Clin. Soc.,* vol. xiv., p. 107.
‡ *Med.-Chir. Trans.,* vol. xxvii.

of months or years becomes converted into a number of abscess sacs owing to pyo-nephrotic distension of the calyces, and the ureter may atrophy after becoming quite impervious. Haviland has recorded such a case.*

Symptoms.—The symptoms of injury to the kidney are compounded of those common to all injuries of abdominal organs, such as (1) collapse and severe vomiting or retching, the manifestations of internal hæmorrhage, and later of peritonitis, (2) local indications, such as lumbar pain, ecchymosis, and swelling both pain and swelling extending in directions radiating from the site of the organ injured, and being attended in some cases with definite attacks of renal or ureteral spasm ; and lastly, disturbance of the normal functions of the kidneys, as evidenced by alteration in the character or quantity of the urine, which shows itself principally in hæmaturia and diminution or actual suppression of the secretion. The symptoms do not always supervene at once, even when the kidney has been badly ruptured or a good half of it even pulped. Many cases might be quoted in proof of this. In one instance known to me, a young man was kicked in the loin early in a game of football, yet he played the game through, walked over a mile after changing his clothes and drinking some beer, and it was only on discovering later that he was passing blood that he began to feel faint and ill. Mynter describes a case where a man went on with his work as a brakeman to a freight train and rode thirty miles before he began to have faintness, pain, and vomiting, yet half his kidney was completely pulped.† On the other hand, patients have been killed off quite suddenly in two hours or less.‡

Collapse.—The first effects of contusion of the kidney, even when not associated with extreme violence or widespread injury, are faintness and loss of consciousness; these may be of short duration, or possibly not sufficiently profound to prevent the patient staggering to a place of safety or his home. On the other hand, the collapse may be deep and of long duration, extending from some hours to as long as five days. The face is pale and drawn and covered with sweat, the temperature subnormal, the pulse quick and small. The injured person may

---

* *Path. Soc. Trans.*, vol. x., p. 209.   † *Ann. Surgery*, 1891, No. 14.
‡ *See* Dunlop's cases, *Lancet*, 1880, vol. i., p. 91.

either lie quietly without expression of pain, and though un-
willing to speak, exclaim when moved or examined; or
may be groaning or crying out with agony. Attacks of
vomiting usually supervene, and may be frequently repeated
during the next few days. When continued beyond the period
of collapse and reaction, the vomiting may be attributed to irri-
tation of the peritoneum by blood effused into its cavity or behind
it and pushing it forward; or by extension of clot into the neigh-
bourhood of the cœliac axis and sympathetic nerves and ganglia,
or between the attachments of the mesentery.

The aspect of the patient immediately, and for some hours or
days after the accident is in some cases discouraging in the extreme,
so that to the inexperienced recovery might appear impossible,
though the course of these cases shows that in the absence of pro-
gressive anæmia this is not really of such grave import. In other
cases, even though death be imminent, the appearance of the patient
does not arouse serious concern. He may apparently recover,
and rising, at once continue on his way or at his work, and only
after some minutes or perhaps hours manifest signs of collapse.
This may be the result of slowly developing hæmorrhage or may
be associated with injuries to other organs, for, as Küster points
out, these variations are not met with in uncomplicated punctured
wounds of the kidney, whereas they are quite usual as representing
the effect of abdominal injury on the central nervous system.

Ecchymosis.—Local indications of renal injury may be abrasion,
ecchymosis, or the appearance of blebs in the kidney region,
either in front or behind; they are, of course, by no means con-
clusive. There is not usually any ecchymosis of the loin or renal
area of the front of the abdomen, though sometimes, when the
injury has been caused by the kick of a horse or the transit of
a carriage wheel, some bruising of the surface may co-exist with,
but be quite independent of, the extravasation of blood from
the torn kidney. Of more importance are the evidences of ex-
tension of deep hæmorrhages which show themselves on the
surface; thus the appearance of ecchymosis or bruise-like dis-
coloration of the skin in the region of the external abdominal
ring, apart from local injury, indicates effusion of blood along the
connective tissue around the spermatic vessels, or possibly by way
of the circumflex iliac artery.

In Gerard Marchant and Aldibert's case * a man, aged thirty-seven, was thrown from a vehicle, striking his left false ribs. Shock, pain and hæmaturia, with oliguria followed, and subsequently polyuria, peritonitis, renal swelling, and **ecchymosis** appeared **at the root of the penis and over the external orifice of the inguinal canal,** with œdematous infiltration of the epididymis and spermatic cord. There was vigilant resistance of the abdominal muscles. Through a lumbar incision a litre of blood was forcibly ejected, the kidney was found in two parts, the lower encapsuled and an inch and a half away from the rest. Both portions were removed and bleeding from the hilum controlled. The quantity of urine increased from 760 to 1,450 grms. in six days and the patient recovered. The rent in the kidney was from above downwards and from without inwards.

Pain.—Pain in the side may be simply the result of superficial injury, in which case it lasts but a day or two; or it is only elicited by pressure; or it may be due to fractured ribs.

Pain actually due to the kidney injury may occur at the moment of the accident, with a painful sense of crackling in the body apparent to the patient; it may continue as a boring or shooting sensation deep in the loin or back, and may radiate in various directions from that point but especially towards the groin, testicle, and thigh, being attended with painful contraction of the cremaster. The pain is increased with change of position and pressure on the loin, so that the patient shrinks from examination and assumes some posture of comparative ease from which he refuses to be disturbed.

Later there may be a feeling of severe tension due to the effusion of blood or urine or both. The occurrence of testicular pain and retraction is usually associated with severe hæmaturia, and is due to the spasm of the ureter excited by the passage of clots.

In a case † of injured kidney, owing to a severe contusion of the left side of the abdomen from a fragment of shell, "the shock was great and of long continuance; there were a bruise in the left flank, excessive tenderness and pain, anuria, and

---

* "Diagnosis and Surgical Interference in Lacerations of the Kidney," 1889.

† "Medical and Surgical History of the War of the American Rebellion," vol. ii., p. 20.

retraction of the left testicle." In another case,* which recovered, the injury was caused by a fragment of shell; there was pain along the ureter, retraction of testicle, smarting at the orifice of the urethra, difficulty in micturition, and occasionally tubular clots of blood in the urine. The hæmaturia continued for three weeks after the injury, and then the patient gradually convalesced.

Other pains of a neuralgic character arise from the involvement of nerves in the injury, and follow the course of their distribution: pain on inspiration indicates interference with the diaphragm often associated with restrained thoracic respiration and contraction of the abdominal muscles; and the patient perhaps speaks unwillingly, with effort, and in a low whisper.

Tumour.—The development of a swelling, from extravasation within or without the kidney, sometimes occurs so rapidly as to be immediately apparent to the eye, and sometimes its appearance is postponed for several weeks, or it may not occur at all. The effusion of blood outside the kidney is often augmented by extravasation of urine, and in cases where the pelvis only is injured, urine may be the principal or sole constituent.

Such a tumour, whether a hæmato-nephrosis or a circumrenal extravasation, is rounded in form and slightly movable both from side to side and in the antero-posterior direction. The percussion note over it is dull, the colon being pushed inwards towards the middle line, though it may in rare instances be found in the loin or even in the hypochondrium. Fluctuation may sometimes be felt, but usually at a late stage.

The appearance of meteorism, seldom intense, like hiccup, regurgitant vomiting, and melæna, are rather indications of concomitant injury to the intestine; and similarly, effusion in the peritoneal cavity, whether serum, blood, or urine, is evidence of extension of injury to that membrane, which generally gives rise to fatal peritonitis.

Hæmaturia.—Hæmaturia is a very common symptom. It occurred in sixty-five out of seventy-one cases collected by Maas. It may be stated at once that the hæmaturia following an injury to the loin, or the front of the ilio-costal area of the abdomen, is not necessarily due to *ruptured* or *lacerated* kidney; and, on the other hand, that hæmaturia is not always present

* "Med. and Surg. Hist. of the War of the American Rebellion," vol. ii., p. 21.

when the kidney is severely lacerated or completely ruptured. If the ureter becomes plugged by clot, so that neither blood nor urine can get down to the bladder from the injured organ, hæmaturia cannot occur, and the kidney may be ultimately lost as an excreting organ. If the cortical substance of the kidney is only superficially lacerated there need not be even the smallest drop of blood passed with the urine.

1. Hæmaturia may denote simply contusion of the kidney. This, I believe, was proved by two cases, in each of which a boy was run over by a carriage. In each case there were collapse and præcordial pain, as well as pain in the affected loin. In one case there was no difficulty or pain in micturating throughout; in the other the catheter had to be used at first. In each case the urine was mixed with a large quantity of blood; in one the hæmaturia continued for three days, and in the other for four days. In neither case was there any contusion of the surface, or any swelling in the loin. Both patients were well within a fortnight, though slight localised peritonitis had occurred in one.

2. Hæmaturia may occur by transudation from the temporarily congested cavity of the kidney, and without any appreciable breach of surface, just as bleeding may occur from the nose or from the vascular lining membrane of any other cavity of the body. Toxic hæmaturia and the bleeding excited by irritants, such as cantharides and turpentine, is unattended by any definite lesion of tissue. It is more than probable, when hæmaturia follows some muscular strain, that the blood is derived by transudation from suddenly congested vessels in some part or other of the urinary tract, not necessarily from the kidney at all. In some cases after death the interior of the kidney has been filled with blood, though no lesion of the tissues could be discovered. In other cases a sudden strain has displaced a small calculus which previously had been encysted within the kidney. Hæmorrhage caused in this manner may be severe and of long continuance.

3. Hæmaturia of a temporary character may be caused by an embolus or thrombus within the renal vessels, and this may be associated with some sudden muscular strain.

4. When hæmaturia is not an immediate or a very early

symptom of an injury, but appears at a later period, *i.e.* a day or two afterwards, it may be the consequence of inflammation extending from the damaged circumrenal cellular tissue to the kidney, which has not itself been injured.

5. Simple shaking of the kidney, as in horse exercise, seems in certain individuals always to excite slight hæmaturia. The mere change from one pace to another, as well as the prolonged fatigue of riding, have been said to cause in some men bloody urine accompanied by lumbar pain.

6. The results of shaking of the kidneys are more marked in persons who are afflicted with renal calculus or gravel. Conversely, traumatic lesions of the kidney predispose to the formation of renal calculus or gravel.

7. Hæmaturia which is due to a pre-existing cause may be noticed after an injury, as in a boy, aged fifteen, who after striking his side had persistent hæmaturia, which on inquiry was found to have occurred on previous occasions, and to be due to a villous growth in the bladder (Newman, p. 312).

8. Dr. Tiffany cautions American surgeons against concluding that all are cases of injured kidney in which hæmaturia follows violence, by reminding them that in the region from Washington to the Capes of Chesapeke, hæmaturia is not uncommon after injuries, but that it is due to malarial causes, not to the injury, and that an examination of the blood in these cases will prove the malarial origin of the bleeding.

9. Renal hæmaturia of an intermittent character occurs from many causes, from Bright's disease, calculus, renal angeioma, and from excess of uric acid in urine.

When the kidney has been *contused* or deeply lacerated, the quantity of blood passed with the urine during the first few hours sometimes amounts to many ounces ; as a rule there is a small quantity at least during the first few acts of micturition. In some cases blood may be passed immediately after the accident, continue for a day or so, and then disappear, to recur, perhaps, in a few days, or not until fifteen or sixteen days later, on going to stool or making some other strong muscular effort.* Such hæmorrhages may recur two or three times, or more.

* See *Guy's Hospital Reports*, p. 470 (1844).

M. Gelley * has recorded a striking case of recovery after injury to the right kidney, followed by immediate hæmaturia which lasted five days, and later on by recurrent attacks of hæmaturia. The recurrences happened on the twelfth day after the injury and lasted nine days; and on the twenty-ninth day, and lasted three days. The patient was a man, aged sixty-two, who was injured by the wheel of a passing carriage.

In other cases the hæmaturia may be slight at first, and increase exceedingly later on. Mr. Reeves has published † the case of a lad, aged nineteen, who fell from a cart and sustained a very severe contusion of the right kidney. For nine days there was only very slight hæmaturia, but on the tenth and three succeeding days large quantities of nearly pure blood were discharged. The patient died at the end of the fourth week, and at the autopsy most of the right kidney was a broken-down pulp, situated in a large retro-peritoneal space filled with blood and blood-clot. There was a false aneurysm of a branch of the renal artery. The bladder was distended with blood-clot and much inflamed. (This is one of the nineteen cases referred to by the author in an article on "Renal Aneurysm" in the *Lancet*, October 6th, 1900.)

In other cases the appearance of blood with the urine has been delayed altogether until the eleventh day (Rayer) or even much longer. In complete rupture, when the kidney is divided into two parts, blood is frequently absent from the urine. ‡ It is also quite certain that the cortical substance may be severely contused, even lacerated in one or more places, without the urine being charged with any blood whatever. Erichsen § records two cases, in neither of which was there any blood in the urine. Hæmaturia may be absent, owing (1) to the ureter or renal pelvis being temporarily or permanently plugged by blood-clot, (2) to thrombosis of the renal vessels, (3) to complete separation of the kidney from the ureter.

Several cases of severe damage to the kidney in which no hæma-

---

* *Revue Médicale de l'Est; Annales des Maladies des Organes Génito-urinaires.*

† *Lancet*, October 4th, 1884.

‡ *See* cases quoted above from *Guy's Hospital Reports*.

§ "Science and Art of Surgery," vol. i., p. 850, 8th ed.

turia has been present might be quoted. Charteris (*Lancet*, 1880, vol. i., p. 90) recorded a case in which the ureter was impervious from the pelvic brim onwards. The patient struck his right side against the corner of a table; there was no hæmaturia, vomiting being the principal symptom, and death occurred from exhaustion from this cause on the thirtieth day. The right kidney was large and weighed seven and a half ounces, and was completely ruptured, the peritoneum was not torn, but a perinephric abscess containing twenty-six ounces of pus had been formed. The ureter was very much dilated in its upper part, and filled with a large quantity of white purulent fluid much thicker in consistence than that in the perinephric abscess; below the brim of the pelvis the ureter was impervious to the pus. C. A. Power (*Trans. New York Acad. of Med.*, 1887) published a case of a woman, aged fifty-two, who died three days after a deep transverse rupture on the posterior surface, together with several smaller ruptures of the left kidney. There was no hæmaturia throughout in this case.

Rayer states that hæmaturia, more or less considerable, indicates without doubt that the kidney has been shaken or otherwise injured, either in consequence of a general shaking of the body; or in a violent effort during which the muscles of the parietes of the abdomen were suddenly and forcibly contracted; or in consequence of a contusion of the lumbar region. But he thinks it is impossible to say, in the majority of cases, what is the precise nature of the renal injury.

It is unnecessary to attach great importance to this uncertainty of diagnosis between the several subparietal lesions of the kidney, viz. *contusion, laceration,* and *rupture,* except from the point of view of prognosis. The contusions and superficial lacerations are very amenable to recovery, whereas complete ruptures are almost certain to cause death from hæmorrhage or peritonitis.

Hæmaturia may continue for weeks or till death, the bladder being distended with blood-clot and extensive hæmorrhage existing around the kidney. In Butlin's case (*St. Barth. Hosp. Rep.*, 1896), J. N., twenty-one, a butcher, fell from a height of twelve feet, striking the left hip; he was able to rise, but felt sick, and staggered on rising to his feet; there was tenderness in the right iliac region and loin, and almost immediately he passed four ounces of bright blood. There was marked collapse after the

accident, but no other symptoms or complications. The hæmaturia persisted for five weeks and was followed by pyuria, though the urine remained acid throughout.

The hæmaturia may intermit for days or weeks, recurring in varying degrees or being absent altogether for a time. The recurrences may coincide with the displacement of a thrombus owing to movement, rough handling of the hæmatoma, as in Nickel's case, or disintegration of clot through the action of urine ; or may be due to emptying of a blood-sac by way of a rent in the pelvis, as cited by Küster.

Blood may appear in the urine derived from other injured parts of the urinary apparatus, such as the bladder, mostly in cases of fractured pelvis, though in these cases other signs are added which make its origin sufficiently obvious.

If the laceration is a severe one, or if complete rupture has occurred, hæmorrhage into the subperitoneal tissue or into the peritoneal cavity will in all probability be great, and then faintness, collapse, pallor, coldness of the extremities, intense anxiety, thirst, cold sweats, and increased pain in the abdomen will be caused. In the urine, which may either be passed off voluntarily or retained in the bladder till withdrawn by the catheter, there may be blood, blood-clots, blood-casts, and even broken renal tubules.

After injury to the kidney, clots may be passed in the urine as long worm-like casts of the ureter. Microscopic blood-casts of the uriniferous tubes are also occasionally found. A case is reported in the " History of the War of the American Rebellion," of hæmaturia persisting for three weeks, and of clots moulded to the form of the ureter being occasionally passed in the urine, which remained albuminous up to the time of death, two months after the injury.

Analysis of Symptoms in twenty-six cases.—Out of twenty-six cases of rupture of the kidney collected without selection from English, Irish, Scotch, and American journals over a period of ten years (1884 to 1893), hæmaturia was a symptom in eighteen, in three very severe, in two remittent, and in two associated with difficult micturition and retention of urine for a period of one week. The hæmaturia lasted three weeks in two cases, and for eight days, seven days, " several " days in others.

A tumour in the loin occurred in twelve of the twenty-six

cases. In one it was evident within an hour, in another it appeared on the fifth day, in others it was delayed for ten days, fourteen days, and in two cases for three weeks and rather more.

In nine of the cases pain was a pronounced symptom, in two it was described as intensely severe.

In some cases after the hæmaturia ceases the urine may continue to be albuminous for a long time. Küster has collected eighteen cases from published records in which albuminuria persisted after the cessation of hæmaturia. In some cases after traumatism without hæmaturia this symptom has existed.

Sometimes, after intense and urgent pain in the abdomen, the next symptom is frequent and painful micturition, the urine voided being highly mixed with blood. In other cases there is no blood in the urine, or there may be entire suppression of urine. The absence of hæmaturia, with a marked diminution in the quantity of urine secreted, is suggestive of plugging of the ureter with blood-clot.

When the ureter is plugged there may be severe renal colic; but this is more likely to occur when comparatively small clots are passing along to the bladder, than when a large coagulum fills the renal pelvis or completely stops the upper end of the ureter.

Coagulum formed in the pelvis of the kidney or ureter is usually passed piecemeal into the bladder. Sometimes, however, it remains either adherent, or entrapped above the narrow upper end of the ureter, leading to hydro-nephrosis. In a case recorded by Holmes such a clot was found post-mortem eighteen months after an injury in the kidney region.

Blood rapidly effused in the kidney or renal pelvis finds its way directly to the bladder and produces an urgent desire to micturate, pure liquid blood being apparently passed without difficulty in most cases; in others, however, the effort is fruitless. This inability may be due in some cases to reflex inhibition and in others possibly to incompetence of the abdominal muscles, as a result of injury; but sometimes it is due to clotting of the blood within the bladder and the valve-like action of a portion of clot at its neck, or to the worm-like clots from the ureter temporarily stopping the passage of the urethra.

The retention causes great distress and also gives rise to pain

at the end of the penis resembling that of vesical calculus. It is, however, relieved by the passage of a catheter, and the escape of the clots.

When the blood flowing slowly into an empty bladder clots there in mass, it may produce a coagulum around which the bladder contracts without chance of relief even by the catheter. This state of things is attended by most urgent symptoms, and by the development of a tumour which can be felt above the pubes.

Blood which has remained long in contact with urine, in the bladder, or elsewhere, assumes a brown hue, and the corpuscles lose their form and colouring matter, and become unrecognisable.

Later symptoms.—After the effect of shock or loss of blood has passed off, the local pain may continue, and be increased by deep inspiration ; the pulse will perhaps become sharp and rapid, the skin hot and feverish, the tongue furred, and nausea and vomiting may arise.

If the injury has been inflicted from the front of the body, tympanitis, abdominal pain and tenderness, and other signs of traumatic peritonitis may set in.

When the case is going to terminate favourably, the urine, which shortly after the accident appeared perhaps to be almost pure blood, may within two or three days become entirely clear, first in colour, and then by degrees of every trace of albumen ; the pain may become less and less ; the pulse decline from 160 beats or more to 80 or less ; nausea and vomiting will cease ; the bowels will act naturally, and the patient slowly or even rapidly return to usual health.

In certain cases, presumably of contused if not slightly lacerated kidney, the whole of the above phases have been passed through in the course of a week or ten days.*

In other cases inflammation occurs in the kidney, the urine then becomes mixed with mucus, renal epithelium, or pus ; and the cure may be effected only after the lapse of many months. Traumatic nephritis is often preceded by the appearance of hyaline casts and of polyuria. One-sided œdema has been observed (Potain) and attributed to disturbance of the sympathetic system.

---

* *See* cases by Lewis, Campbell, Harrison ("Lectures on Diseases of the Urinary Organs," p. 333), *St. George's Hospital Records*, and others referred to in the text.

The urinary symptoms.—Variations in the quantity of urine secreted are common after injury to the kidney, and the normal standard may not be re-established for some days or even weeks. Oliguria may indicate the loss of function of one kidney or temporary inhibition in both. Veret cites twelve cases of polyuria, the quantity varying from 2 to 10 litres in twenty-four hours over a period of from two to five days. Most of the cases were combined with albuminuria, but in two there was none.

Complete anuria.—Cerou, in his Thesis on Oliguria and Anuria due to Traumatism,* has collected six cases of more or less complete anuria after injury to one kidney alone, the other organ, as proved by him in five cases, being uninterfered with and normal. Only one of the six cases recovered.

In Butler's case (*Lancet*, vol. i., p. 79, 1890) anuria existed for thirteen days and was due to atrophy of the opposite kidney, which weighed only 120 grs., and to permanent impaction in the ureter of the damaged organ of a mass of hard gritty thrombus (*see* Part II., Vol. II., p. 476).

The entire suppression of urine indicates injury to an unsymmetrical, an atrophied, or a solitary kidney, or to both kidneys, attended possibly with plugging of the renal vessels, as in a case reported by Moxon; or it may be due to an inhibiting nervous influence, such as occasionally seems to arise after severe operations,† or to the collapse produced by the injury, or to the general failure of function which may precede death.

Retention of urine may result from the impaction of blood-clot in the urethra or neck of the bladder, from rupture of that viscus, or from paralysis of the abdominal muscles as a result of injury.

Abdominal swelling in certain instances has come on rapidly, and been attended with fluctuation.

To recapitulate:—After the first onset of the symptoms, which are those of intense localised pain, and possibly of collapse with loss of blood, there are six chief dangers to anticipate: (1) continuous and excessive extravasation of blood leading to death by syncope within a few hours or a day or two; (2) peritonitis, either as the direct effect of the violence, or of the

* " De l'Oligurie et de l'Anurie," Paris, 1877.
† Dickinson, " Renal and Urinary Affections," vol. iii., p. 1299.

tension and ulceration of the peritoneum due to the accumulation of blood and urine which has been extravasated behind it; (3) inflammation and suppuration of the perinephric tissue; (4) occlusion of the ureter by blood-clot, and the retention of urine within the cavity of the kidney, and its attendant effects of hydro-nephrosis, pyo-nephrosis, pyelo-nephritis, renal abscess or renal atrophy; (5) simple traumatic nephritis; (6) when the renal pelvis or calyces are opened so as to allow of the escape of urine, secreted by the damaged organ, into the perinephric tissue, a vast tumour may be formed by the accumulation of the extravasated urine, or urine and blood; and, if both blood and urine are extravasated, they will undergo septic changes if not soon evacuated by lumbar incision.

When injury to the kidney is associated with other visceral lesions, such as rupture of the liver, spleen, lungs, or heart, or with fracture of the skull, spine, or pelvis, the symptoms may be so serious, complicated, and rapidly fatal as to mask all signs of rupture of the kidney, except perhaps the presence of blood in the urine.

When there is an absence of blood in the urine, injury to the kidney must nevertheless be suspected if there is pain in the renal region, together with collapse or the appearances of internal hæmorrhage. There will, too, sometimes be fulness and dulness of the injured loin, and the abdominal muscles on the affected side will be rigidly contracted and hard. Unless the pelvis of the kidney is torn, there will be no great amount of urinary extravasation. It would appear from certain cases of nephro-lithotomy, as well as from other operations on and lacerations of the kidney, that the torn surface of the renal parenchyma does not secrete any urine, and that for any considerable urinary extravasation to occur it is necessary to have a wound communicating directly or indirectly with the pelvis of the kidney. The late Sir Spencer Wells * published an extraordinary case which tends to support this view.

Prognosis.—Owing to the depth at which the kidneys are situated, for the most part under shelter of the costal arches and in close proximity to the vertebral column, injuries to these organs must necessarily seldom be uncomplicated. In falls and

* *British Medical Journal*, April 19, 1884.

crushes and such widespread traumatism, which are for the most part associated with lesions of one or both kidneys, the general shock and damage to other important and remote parts of the body tell conspicuously in prognosis ; and in gunshot and penetrating wounds, as well as in more localised contusions caused by the thrust of blunt objects, the degree and nature of injuries to intervening parts and organs cannot be left out of account.

That even deep lacerations and severe contusions are not necessarily fatal is admirably shown by museum specimens.

In the pathological cabinet of the New York Hospital is a specimen which shows the repair of a rupture of the kidney that almost completely divided the organ horizontally near the centre ; "lymph is copiously effused between the separated surfaces and upon the exterior."

Recovery may even follow laceration of the kidney and obliteration of the corresponding ureter. Such a case is recorded in the London Pathological Society's *Transactions*,* the patient subsequently dying of granular disorganisation of the other kidney. The specimen is in St. George's Hospital Museum.

There are many cases published of recovery after injury, in which there is reason to believe that the kidney has been lacerated ; † and others in which it has been positively ascertained that healing had taken place prior to death from other causes.

The proof of the cicatrisation of wounds of the kidney is found in persons who have lived for some weeks, or longer, after laceration of the organ, and have died from some other cause. Such was the case reported by Athol Johnson,‡ of a man, aged thirty-eight, who ruptured his liver and right kidney, and fractured his seventh cervical vertebra. He died from the effects of the injury to the spine three weeks afterwards, and at the post-mortem there were found, besides an extensive rupture of the right lobe of the liver, several ruptures, all beautifully united on the anterior surface of the right kidney. The preparation in St. George's

* Vol. xi., p. 140.

† Dr. M. Campbell, *Brit. Med. Journ.*, p. 225 ; Feb. 2, 1884. W. B. Lewis's case of ruptured kidney, recovery, *Med. Times and Gazette*, p. 228, Aug. 20, 1870. Harrison, *op. cit.*, p. 333. "Medical and Surgical History of the American War of the Rebellion," vol. ii., p. 20.

‡ *Med.-Chir. Trans.*, vol. xxxv., p. 55.

Hospital Museum * shows how completely repair may take place in a kidney, even when both organs are small, granular and cystic. The inference is that in this case the renal disease existed long before the injury occurred to the kidney. The man lived and was well, with only one kidney, and that one small, granular, and cystic, the function of the other being completely suppressed by the clot in the ureter. Although it is now common knowledge that accidental injury to a kidney followed by recovery must have been very common, yet in 1860 Holmes was unable to find an account of the dissection of such an organ.

Lacerations affecting only the cortical substance are often healed by the effusion into them of coagulable lymph or by the organisation of blood-clot, which temporarily checks the further extravasation of blood and of urine, and ultimately forms the cicatrix.

A fatal result may be brought about by collapse, hæmorrhage, or peritonitis, or at a later date by pyæmia, cystitis, hectic fever, or exhaustion from abscesses excited by urinary extravasation, or by broken-down tissues, or blood-clot; or death may occur from peritonitis or collapse, set up by the bursting of the contents into the peritoneal cavity, through a sloughing of the limiting membrane of the abscess. If the ureter become permanently obliterated after injury, the kidney becomes atrophied, or death may be caused by suppuration of the organ.

In the ninety instances of subcutaneous injury collected by Edler the number of fatal cases was exactly equal to that of recoveries, seventeen dying within forty-eight hours and the remainder three weeks or more later. An analysis of the cases shows the prognosis of uncomplicated subcutaneous injuries of the kidney to be fairly good, fatalities being due to primary hæmorrhage or to subsequent suppuration and peritonitis, and constituting about one-third of the number.

In complicated kidney injuries the prognosis is very bad, but not necessarily fatal.

In a series of 306 cases collected by Küster, there were 162 recoveries and 144 deaths (a mortality of 47 per cent.). Among 222 uncomplicated cases there were only sixty-seven deaths (a mortality of 30 per cent.); whilst eighty-four cases complicated

* *Trans. Path. Soc.*, vol. xi., p. 140.

with injury to the brain, spinal cord, bladder, or other abdominal organ, peritoneum, pleura, or lung, or involving damage to both kidneys or to a "fused" or an "unsymmetrical" kidney, yielded seventy-seven deaths.

Death occurred in	10 instances in	24 hours
	13	,,	,,	6 days
	21	,,	,,	3 weeks
	9	,,	,,	2 months
	6	,,	,,	10 months
	6	,,	,,	20 years
	2	,,	,,	unstated.

67

The causes of death were: shock in 5; hæmorrhage in 30; suppuration in 27; chronic nephritis in 3; and calculus and œdema of the lungs in 2.

Death from hæmorrhage was most common, bleeding being immediate, recurrent, or continuous. There were four instances of traumatic aneurysm. Only one case in which the kidney was ruptured into the peritoneal cavity recovered, and that only after immediate operation (Kehr).

Keen gives sixty-seven recoveries in 117 cases, but deducting seventeen cases in which either the opposite kidney was injured or absent, or the patients died from other injuries, he finds 100 cases with sixty-seven recoveries, i.e. a mortality of 33 per cent. But from his analysis of these cases he thinks the mortality might have been reduced to 23 per cent. had nephrectomy, primary or secondary, been practised in some of the fatal cases. Out of twenty-two cases in which nephrectomy was performed there were eight deaths, i.e. a mortality of 36.4 per cent.; whereas the percentage mortality of the remaining seventy-eight cases, in a large number of which the injuries were very slight, was 34.5.

Out of thirty-four fatal cases (excluding cases with one kidney and in which death was due to other injuries), Keen found that death was due to hæmorrhage and shock in fourteen; to suppuration, including peritonitis, in sixteen, leaving coma, anuria, and nephritis the causes of four deaths. These figures confirm what I have before stated, namely, that the two chief dangers of rupture of the kidney are hæmorrhage, primary or secondary, and suppuration, either in the perinephric tissue or in the kidney itself.

The causes of death in fourteen fatal cases out of the total of twenty-six subparietal injuries which I collected from American and English sources, from 1884 to 1893, both years inclusive, were as follows :—

Seven were from hæmorrhage. In five the hæmorrhage was into the retro-peritoneal tissue, and death occurred in twenty-four hours, sixty hours, four days, six days, and nine days respectively. In two the hæmorrhage was into the peritoneal cavity, and derived probably from other ruptured organs ; one of these died twenty-nine hours after the injury, and nine hours after the spleen and left kidney had been simultaneously removed by abdominal laparotomy ; the other, a woman, aged fifty-two, fell from a second-floor window and ruptured the left kidney, the liver and spleen ; at the autopsy the abdominal cavity was full of clotted blood and serum ; the left kidney had a deep transverse rupture on its posterior surface and several other smaller ruptures. The patient died on the third day. No hæmaturia throughout.

Two deaths were due to peritonitis, one month after the injury.

One patient died, after nephrectomy, from ascending pyelo-nephritis and cystitis due to retained blood-clot.

One died from perinephric extravasation of blood and urine twenty-one days after the injury. The lumbar swelling did not appear until the fourteenth day, and was opened six days later (the day before death). There was a rupture along the middle of the anterior surface and complete detachment of the lower one-third of the kidney.

One died from uræmia of four days' standing and a perinephric abscess, following on a suppurating sinus which had existed since three weeks after an injury three years before. The opposite kidney was in a state of acute pyelo-nephritis, and two-thirds of the injured kidney was quite destroyed ; only the upper third existed, and this could not be found at the time of the lumbar incision.

One death was due to uræmia of thirteen days' standing, commencing four days after the injury, owing to permanent occlusion of ureter with blood-clot. The opposite kidney was cystic and atrophic. Death occurred on the seventeenth day.

One death occurred on the eighteenth day from injuries to other organs.

The mortality is considerable because injuries of the kidney, or its pelvis, are likely to be complicated with injury to the peritoneum, or to be themselves complications of various kinds of fractures of the adjacent vertebræ or ribs. When the liver or spleen is ruptured as well as the kidney, the prognosis is very unfavourable.

When the injury is limited to one kidney, and death occurs within a few days, the cause of death is usually collapse from hæmorrhage; but in by far the larger number of rapidly fatal cases there are lesions of other viscera besides. Thus, of twelve fatal cases from the Middlesex Hospital post-mortem records there were ten in which the liver was ruptured, and in some of these the spleen or lungs, or both, were ruptured as well. In one case there was rupture of the heart and fractured ribs, with partial rupture (deep laceration) of the left kidney. Usually in the fatal cases death occurs from shock or syncope within a period varying from an hour or less to twenty-four or thirty-six hours. When life is prolonged beyond two or three days death may occur in a week from pleuro-pneumonia if the ribs are fractured and the lungs contused. This was the cause of death on the fourth day in one of my cases; and on the second day in one of the cases recorded in St. George's Hospital Catalogue. In a case under the care of Mr. Erichsen, pneu-monia was the cause of death nine weeks after laceration of the left kidney by a buffer injury. Experience shows the necessity of being guarded in our prognosis, because some cases which at the outset looked very serious, and even alarming, have quickly recovered; whereas others, apparently far less serious, have terminated almost suddenly in death.

In rupture of the kidney, its pelvis, or ureter, the prognosis as far as life is concerned is less unfavourable than in rupture of the other abdominal organs.

It is largely due to the plugging of the renal blood-vessels, and to the capacity of the other kidney, if healthy, for doing compensatory work, that so many recoveries from contusion, laceration, rupture, and puncture of the kidney take place; but the two chief conditions upon which recovery depends are, the escape of the peritoneum, and of the large branches of the renal artery and vein. If a large branch of the renal artery be torn, and death does not quickly follow from bleeding, the gradually

increasing hæmorrhage is likely to lead by pressure to sloughing of the peritoneum, even though that membrane may have escaped the original injury.

Diagnosis.—Except in the case of very slight injury, the local indications of pain, tenderness and swelling in the kidney region and the occurrence of hæmaturia, with possibly fibrinous casts of the tubules and broken-down corpuscles, or of albuminuria persisting after the accident, are sufficient indications of the nature of the injury. It is more than probable that some of the cases which have been regarded as examples of recovery from ruptured kidney were not really cases of rupture. For example, a lad, aged fifteen years, had been run over, and for three days suffered pain in the hypochondrium, and vomited at intervals. There was blood in the urine on and after the day of the accident, and on the fifth day a quantity of granular matter with uric acid crystals, a little blood, and some casts, were voided in the urine. On the seventh day the urine was clear, and on the tenth the boy seemed well and continued so afterwards. In this case, though the organ was all in probability contused, one cannot but suppose that recovery would have been less rapid if the kidney had been ruptured. In some cases of hæmaturia after a blow on the abdomen, the injury was probably a contusion of the bladder, not a lesion of the kidney at all. This possibility has to be borne in mind, especially when pain and other local symptoms are absent.

After injury to the kidney or ureter, the symptoms are sometimes too obscure, or insufficient, for accurate diagnosis. When there is no hæmaturia it is impossible, at first, to say whether the pains in the loin are due to injury to the muscles, to extravasation of blood in the circumrenal tissues, or to a lesion of the kidney itself. If a very acute pain is felt in the loin, without any noticeable alteration in the composition and quantity of the urine, there is a strong probability that the injury is not of the kidney. This, however, cannot always be relied upon. In Stanley's two cases,* the urine was passed naturally and freely, and there were no symptoms leading to a suspicion of injury to either ureter or kidney, until a large tumour, from which fluid containing urea was drawn away, formed in the right hypochondrium of one, and in the lumbar region of the other.

* *Med.-Chir. Trans.*, vol. xxvii.

In Poland's valuable case,* which I had the opportunity of watching when house surgeon at Guy's Hospital, the precise nature of the injury remained doubtful up to the time of death, owing to the almost entire absence of urine during the six days the patient lived. The absence of urine was due to thrombosis of the renal vessels of one kidney, and the rupture of the pelvis of, and extravasation of urine from, the other kidney. Thrombosis of the renal vessels, as a result of violence to the lumbar region of the spinal column, is a possible occurrence, and should be remembered in relation to renal injuries, and to suppression of urine after injury to the back. Moxon † has described a typical example of nearly complete obstruction of the vessels of both kidneys, in a man, aged twenty-two, who was struck in the back by an engine.

If, when the collapse from an abdominal injury has passed off, pain in the hypochondriac or lumbar region continues, and there is vomiting and anxiety of countenance ; if, moreover, the urine contains blood and blood-casts, gradually diminishing in quantity during three, four, six, or seven days, or longer ; and if convalescence is slow, the suspicion that some contusion or laceration has occurred is justly aroused.

If after the abdomen has been run over, or the patient has fallen, or been struck on the abdomen or loin, faintness, coldness, vomiting, and abdominal pain follow ; if on the day of, or the day after the accident, and whether the catheter be required or not, the urine is found to contain a quantity of blood and blood-clot ; and if after several days blood-clots continue to pass, or pus as well as blood is voided in the urine ; if, moreover, there is pain along the course of the ureter, with retraction of the testis, or a rigid and prominent state of some of the muscles of one side of the abdomen, with frequent desire to micturate ; or, finally, if a tumour, dull on percussion, forms in the loin or lumbar or hypochondriac region of the abdomen, accompanied or not with signs of local peritonitis, there are safe grounds for believing that either the kidney or its pelvis has been ruptured. The passage of blood-clot along the ureter into the bladder is sometimes a source of great suffering, and

* *Guy's Hospital Reports*, 3rd series, vol. xiv.
† *Ibid.*

of cystitis. A typical and instructive case which was under Hilton was made the subject of a valuable clinical lecture* by that philosophic surgeon. The clots frequently assume the shape of the pelvis of the kidney; sometimes they are long, worm-like casts which have been moulded in the ureter, and sometimes they are blood-casts of the uriniferous tubes. The latter may be seen, if looked for, after even slight injuries such as contusions of the kidneys. If the bleeding is not profuse, the clots cease to pass after a few days.

Mr. Cock recorded † a case of rupture of a *single* kidney, in a lad eighteen years old, who fell from a height on to some rafters. The patient died comatose on the eleventh day. The left kidney was completely divided through its pelvis, and the two halves were widely separated by a large collection of blood and urine, which had been extravasated very widely into the cellular tissue behind the peritoneum. The kidney and ureter were nearly twice the normal size, owing to the rudimentary state of the right kidney. There was congenital absence of the upper part of the right ureter, vein, and artery.

In other cases also, referred to in this chapter, there were dulness and swelling in the lumbar and iliac regions, caused by the extravasation of blood when the kidney was completely ruptured, and by the effusion of blood and urine when the pelvis of the kidney was torn. It is sometimes difficult to diagnose such swellings from tumours due to distension of the cavity of the kidney with blood-clot (hæmato-nephrosis). Rayer ‡ has recorded a case of this kind, and has made remarks upon it to the following effect:—

Hæmaturia, more or less considerable, is the most constant result of contusions of the kidney; but it is exceedingly rare that blood, after having coagulated in the ureter or pelvis of the kidney, accumulates to such an extent as to distend the kidney and to transform it into a large sac which extends from the hypochondrium to the iliac fossa. Renal tumours of this dimension are usually the consequence of pyelitis, of a hydro-nephrosis, or of a cancerous, tuberculous, cystic, or hydatid

* *Guy's Hospital Reports*, 3rd series, vol. xiii., p. 9.
† *Trans. Path. Soc. Lond.*, vol. i., p. 293.
‡ "Traité des Maladies des Reins," vol. i., p. 280.

degeneration. One can recognise, or at least suspect, that the distension of the kidney is a sequence of an internal hæmorrhage by the nature of the case, and the rapidity of the development of the tumour. Undoubtedly it will be difficult to distinguish during life a tumour formed by an extravasation of blood around the kidney and outside the peritoneum, from a tumour caused by the dilatation of the kidney by blood accumulated within its cavity. Yet, in extra-renal hæmorrhages the tumour generally appears soon after the accident, and is not circumscribed like renal tumours. A tumour due to blood effused within the cavity of the renal pelvis (hæmato-nephrosis) is formed later, and more slowly, than an infiltration of blood into the retroperitoneal cellular tissue, as the kidney is distended with more difficulty than the peritoneum can be detached from its connections.

Mounier has reported (*Gaz. des Hôpitaux*, 1849, p. 148) a case somewhat similar to the one referred to by Rayer.

The figure given in a later chapter (Fig. 70, p. 475) illustrates a hæmato-nephrosis, and shows the condition of the renal cavity after the pyramidal parts have been greatly destroyed. It is from the body of a man, aged twenty-five, who died of purpura ; there is no account of his having received an injury.

Treatment.—The first requisite in the treatment of a case of renal injury is commonly the combating of shock, which is often prolonged and profound. Professor Küster considers the hypo-dermic injection of a solution of camphor highly efficacious in rousing the patient from the state of collapse, in addition to the ordinary treatment by warmth. In all cases in which contusion or rupture of the kidney is suspected or known to have occurred, absolute rest in bed must be observed ; stimulants and solid food must be avoided, and pain and restlessness must be allayed by the subcutaneous injection of anodynes. The internal use of gallic acid, infusion of matico, ergot of rye, and the preparations of iron have been recommended to check hæmorrhage, and may be tried ; acetate of lead, combined with opium, has been employed for the same purpose. The liquid extract of ergot in drachm doses every two hours until four doses have been taken, or in half-drachm doses every three hours, and repeated as long as circumstances require it, is, I consider, the most certain and most rapidly effica-cious remedy of this sort ; or three grains of ergotin may be

subcutaneously injected, instead of giving the liquid extract by mouth or rectum. Internal remedies, however, are slow in action and not very efficacious in effect. Certainly no time ought to be wasted by trying them in cases in which operative treatment seems indicated. Thirst should be slaked and sickness checked by sucking ice. Ice given by the mouth assists in checking sickness and lowering the temperature of internal parts and thereby tends to stop internal hæmorrhage.

Pain should be met by an injection of morphia, which will also allay peristalsis in the colon overlying the injured kidney. Pain will be sometimes assuaged by strapping the affected side; a practice which assists in keeping all the parts about the injured organ quiet, and which by gentle compression helps to limit and check hæmorrhage. If the large bowels be full of solid fæcal matter they must be relieved by enemata of oil and water, otherwise they ought not to be disturbed for several days. I have seen sharp hæmaturia from an injured kidney brought on unexpectedly more than a fortnight after the infliction of the wound, and when the patient appeared to be quite convalescent, by the passage of hardened fæcal matter along the colon, and thus across the surface of the kidney. This occurred in a case of nephro-lithotomy in a young man, which I reported to the Clinical Society in 1885. To assist in keeping the intestines free of fæcal matter until sound healing has occurred, and otherwise to avoid undue stimulation of the circulation, only very light articles of diet, and those only in small quantities at a time, should be allowed for two or three weeks at least. It is especially important that the quantity of fluids should be limited as far as possible, because any increase in the activity of the kidneys, under the circumstances, is very disadvantageous.

In cases of injured kidney of every description the diet must be bland in character, chiefly liquid, and limited in quantity.

In Hilton's case, to which I have already referred, the patient, at his own earnest request, was allowed a little solid food on the eighth day after the accident, and from that time fresh hæmorrhage ensued, and the case went rapidly from bad to worse. To quote Hilton's own words, "Up to this time the case seemed to promise a good result. The blood in the urine was daily diminishing; the vomiting, pain, and other general symptoms

were abating in severity. On the seventh day he had a craving for solid food; this was allowed him, and from the period that his diet was improved he retrograded. His urine again became more bloody. The solid food was, of course, at once discontinued; but it had already induced some mischief. It necessarily produced an increase of the vermicular motion in the intestines, and also caused the heart to pulsate more forcibly; and now that we are familiar with the post-mortem evidence we can see how an increased force of the circulation might, and probably did, dislocate a clot which was closing the mouth of a torn artery."

Every precaution should be taken against exciting irritability of the stomach; and if vomiting occurs the patient should be fed entirely by nutritive enemata. Fresh ·hæmorrhage is apt to be excited by the detachment of clots, and the reopening of plugged vessels by straining efforts. Vomiting, therefore, as well as defæcation and the peristaltic action of the intestines, are to be prevented if possible. In all abdominal injuries in which hæmorrhage is to be feared, intestinal and gastric activity is undesirable, and therefore solid food and aperients of every sort are to be forbidden. To solid food there is a twofold objection: it stimulates the action of the heart, and also the involuntary muscular fibres of the viscera.

When there is reason for thinking that hæmorrhage is going on, either from the continuing collapse of the patient; the quantity of blood voided by the urethra; the diffused dulness and swelling of the loin and renal region of the abdomen, which indicate extravasation into the retro-peritoneal cellular tissue; or from the formation of a circumscribed renal swelling, which is the mark of hæmorrhage into the cavity of the kidney itself; ice bags, or Leiter's tubes through which a stream of iced water is kept running, applied to the loin and ilio-costal area of the abdomen, may be tried, unless immediate operation is indicated. The ice, or iced water, may be applied with advantage outside the strips of strapping, which should reach from the spine to the linea alba.

When the blood-clots are of small size, and the hæmorrhage less considerable, no instruments are required, or should be used, for their removal; they will be voided through the urethra without undergoing decomposition or setting up vesical inflammation.

The urine itself has a solvent effect upon the clots, and this will suffice to get rid of even a considerable amount of blood. But when the blood-clot leads to retention of urine, associated with spasmodic contractions of the bladder, a full-sized catheter with two large eyes must be introduced, and the bladder injected with some antiseptic solution, so as to break up the clot and assist its removal. And if little or nothing escapes through the catheter, Clover's or Bigelow's evacuating syringe should be tried. The error of injecting styptics into the bladder should not be committed.

These methods failing, the last resource will be cystotomy. Although it is needless to say that such an operation should not be contemplated except in obstinate and severe cases, yet where the bladder is more or less distended with blood, and frequent, fruitless, and painful efforts at micturition torment the patient, it is well to bear in mind that a much better prospect of recovery will be afforded by not postponing the operation until the patient is exhausted by hæmorrhage or spasms of the bladder ; or until cystitis has been set up, and the clots within the bladder have decomposed, thereby exposing the patient to the risks of suppurative pyelo-nephritis.

If clots of blood accumulate in the bladder, or are forced into the urethra, and there give rise to such pain and distress as was suffered by Hilton's patient, supra-pubic cystotomy should be performed. The bladder would readily be emptied of clots through the wound above the pubes, and could be kept aseptic by covering the wound lightly with iodoform cotton-wool, through which the urine would percolate. I well remember the question of cystotomy being discussed in the case referred to, and feel sure that it would have saved much suffering had it been performed.

Mr. Rawdon, of Liverpool has put on record * a case in which he adopted this treatment, but unfortunately at too late a period. His patient was a boy, aged twelve years, who was admitted into the Liverpool Infirmary on the day after he had fallen into a stone basement, a height of about eight feet. He was passing blood in his urine, and suffering pain in the right side, and there was a small bruise over the crest of the ilium. For the

* *Brit. Med. Journ. ;* and *Lancet*, May 26th, 1883.

first few days the hæmaturia diminished, but it subsequently increased, and acute cystitis followed. The diagnosis was rupture of the right kidney ; and with the object of preventing blood from entering the bladder, the injured kidney was removed by lumbar nephrectomy on the seventeenth day. This was the first case of nephrectomy for ruptured kidney. The kidney was found to have been torn nearly completely across. Relief followed the operation, but, acute cystitis continuing, lateral cystotomy was performed four days after the nephrectomy, and on the twenty-first day after the injury. Fœtid clots were removed from the bladder through the wound. Relief from the bladder symptoms was obtained, but death followed on the fortieth day after the injury, from pyelitis and suppuration of the substance of the left kidney, due probably to extension upwards from the bladder of the inflammation which had been excited by the presence of decomposing blood-clots there, and by the retention of urine to which they had given rise.

When arterial blood escapes into the pelvis of the kidney, it traverses the urinary passages rapidly, and is quickly expelled by the bladder, which is excited to frequent spasmodic contractions to expel it ; and if this form of hæmorrhage continues, and threatens the life of the patient, despite all the efforts which have been mentioned to check it, an exploratory incision into the loin, followed (if the extent of injury to the kidney indicates it, or the hæmorrhage cannot be checked without it) by nephrectomy, should be resorted to. G. Simon recommends the application of a tampon or the cautery to laceration of the parenchyma, and if this fails or is inapplicable, nephrectomy. Küster's teaching, the general lines of which agree with my own, may be summarised as follows :—

In severe hæmorrhage make an exploratory incision in the loin. If the kidney is ruptured but the fragments are still attached to the hilum, stuff the interstices with gauze.

Suture with superficial stitches the two portions of a kidney if they are attached by the pelvis and hilum (Fig. 30).

If vessels are found bleeding outside the hilum, apply forceps and ligature; if within the pelvis, stuff with gauze.

The main artery is very seldom damaged, and death of the part involved does not necessarily follow occlusion of a branch.

When the pelvis is hard and distended with blood it should be opened and stuffed with gauze after turning out the clot. Stitching the edges of the pelvis to the parietes will facilitate the removal and renewal of the plug, which may be required during two or three days.

More extensive injuries require immediate nephrectomy, but the application of a tampon or clamp may give time to wait for an improved condition of the patient before further procedure.

Effusion of blood or urine into the peritoneum requires abdominal section. The incision is best made along the outer edge of the rectus. After removal of the kidney and suturing of the peritoneum, the space should be drained through the loin.

The best plan is to make an oblique incision in the loin to examine the kidney, and to carry this towards the front of the abdomen, if necessary even to the outer edge of the rectus ; the rent in the peritoneum can then be closed, and lacerations of the spleen or liver attended to, and the cavity washed out with saline solution.

Fig. 30.—Kidney of a boy run over by a cart (pelvic aspect). It is almost split into two longitudinally, and one pole is nearly detached. (St. Thomas's, No. 2056.)

Collections of blood and extravasated urine, causing at a later stage an increasing tumour with pain and fever, demand treatment by lumbar incision. Though Bennett May, Marshall, Croft, and Delabort have reported cases cured by repeated puncture, aspiration ought to be abandoned. It is not requisite for purposes of diagnosis ; it is slow and uncertain in all, and actively harmful in some cases in its effects. Such cases should be treated by a free opening. They should not be allowed to open spontaneously, but should be incised and drained before they suppurate, and the wound in the kidney closed, if possible, by sutures.

When a portion of the kidney is found detached it should be removed ; partial nephrectomies of this kind have been done by Keetley (*Lancet*, 1890, vol. i.), Bardenheur (*Arch. Klin. Chir.*, 1891, xlii., 371), and John B. Nash (*Australian Medical Gazette*, Nov. 20th, 1897, and private communication), and E. Owen (private communication).

The following case, reported from the Marburg Klinik, shows the value of the tampon and drainage :—H. F., aged seven, fell on June 7th, 1891, from a staircase on to sand, striking the right hip. Soon after there was epistaxis, vomiting and abdominal pain. The right renal region was harder than the left, there was no pain on pressure. Five hundred cm. of urine were passed containing blood and albumen. By June 14th there was pain in the right side, pus in the urine, which when removed by catheter, contained blood and granular casts ; and there was increasing anæmia. On the 19th June a lumbar incision was made and a rent discovered in the right kidney. The renal pelvis was opened and cleared of clot with the finger. It was then stuffed with iodoform gauze, and the edges attached to the skin. The tampon was removed after three days, and the fistula closed in seventeen days, the patient being well by July 7th.

In Kolliker's case (1895) arrest of hæmorrhage was effected by tampon in a boy, aged twelve, who after a fall was unconscious and exhibited hæmaturia. On the ninth day there was œdema of the left side of the body, and on the tenth fever and anuria. An incision disclosed blood and urine in the outer capsule, and the kidney loose and rent between the middle and upper thirds, the fissure running forwards and outwards. Both the kidney and loin wounds were stuffed with iodoform gauze. They healed in five and a half and seven weeks respectively.

The kidney should be removed if the tissues are infiltrated or the organ greatly damaged, or extensively suppurating, but not on account of a single abscess merely.

Experience has shown that lives which otherwise would have been lost may be saved by the timely and well-judged employment of lumbar nephrectomy.

Nothing short of nephrectomy was possible in Kehr's case of a boy, aged nine, who fell (December 17th, 1893) from the sixteenth

rung of a ladder, striking the left side of the abdomen against
an iron object, on his way into a shallow cellar. There was no
fracture of ribs, pelvis or extremities, but evidence of contusion
of organs with internal hæmorrhage, accompanied by severe ab-
dominal pain and hæmaturia.

After being conveyed some way by train he was received in
a state of profound collapse, with an increasing tumour producing
dulness over the entire left side of the abdomen. Bloody urine was
withdrawn by catheter. Considering the possibility of intestinal
injury an incision was made under ether from the navel to the
pubes. It was almost bloodless, but half a litre of sanguineous fluid
spurted out of the blue-looking peritoneum as it was opened.
A large hæmatoma was discovered extending from the diaphragm
to the pelvis; in it the lower third of the kidney was involved
and the colon, though itself uninjured, steeped. A cross incision
was made from the umbilicus to the eleventh rib. There was
a sudden rush of blood through a rent in the posterior layer
of the peritoneum, which was controlled by pressure, while the
kidney was ligatured and removed. A second ligature was placed
on the stump and the hæmatoma cleared and washed out, the
operation lasting a few minutes only. The quantity of urine excreted
increased in five days from 200 to 900 grammes. The patient
got up on January 9th, and left cured on the 20th. The kidney
had been torn across between its middle and lower thirds, the vein
and ureter being also torn, the latter two inches from the renal pelvis.

Bernays reports the case of a man, aged twenty-three, who
fell from a vehicle, striking the left lumbar region against the
wheel. For the first twenty-four hours he was in a state of
acute alcoholism with vomiting and purging. There was hæma-
turia, and a swelling dull on percussion appeared in the right
abdominal and lumbar regions. A lumbar incision disclosed a
hæmatoma as large as a child's head, the kidney was torn in
several places up to the pelvis, and was practically detached;
though the artery was torn it did not bleed at the operation.
The urine exceeded 1,500 c.c. during the following two days,
and the patient was well in fifty days.

Wallis, in the Clinical Society's *Transactions* (vol. xxx.), cites
fourteen instances of nephrectomy for subcutaneous lacerations of
the kidney with severe hæmorrhage, of which nine recovered and

five died.   It is best to interfere early in cases of serious hæmor-
rhage, as waiting is productive of a high mortality.

Keen gives twenty-two nephrectomies for subcutaneous ruptures,
with eight deaths.   Five of these were primary nephrectomies
with one death, *i.e.* a mortality of 20 per cent.; and thirteen
were secondary nephrectomies with five deaths, a mortality of
38·5 per cent., showing that secondary nephrectomy is nearly
twice as fatal as primary.   Only three of the cases in which the
form of operation is stated were abdominal nephrectomies; and
of these one died.

Nephrectomy should be entertained in cases of profuse and
continuous hæmaturia, especially if the bleeding is rapid and
arterial; in cases of delayed dangerous hæmorrhage occurring days
or months after an injury, and which is probably due to trau-
matic aneurysms; * and also in cases in which, though hæmaturia
may be slight or altogether wanting, there is a strong presump-
tion from the increasing collapse, pallor, dulness and swelling
of the loin, that the kidney has been severely injured.   In such
cases an exploratory incision should be made down upon the
kidney through the loin, and it will be more than probable that,
just as in Mr. Rawdon's and Mr. Hilton's cases, the kidney will
be found in great part or entirely torn across.

Peritonitis.—When the abdomen has become distended, but
without being entirely tympanitic, a course of calomel and opium
has been adopted as the treatment, under the idea that the
injury has set up traumatic peritonitis.   In certain cases the
result has been satisfactory.†   But, as Athol Johnson long ago
pointed out, the distended state of the belly and the pain which
is usually so much complained of in the first instance, are not
caused by inflammation, but are due rather to the stretching of the
peritoneum and its numerous nerves, which are derived both
from the cerebro-spinal and sympathetic systems.   If, however,
traumatic peritonitis should be excited and there has not been much
loss of blood, it must be treated in the early stages by the appli-
cation of twenty or thirty leeches, followed by cold compresses,
flannels wrung out of iced cold water, or Leiter's tubes, to the abdo-
men.   In the later stages, cold applications and leeches are out of

* *See* Nasse, *Berliner klin. Wochenschrift*, August 22, 1898.
† *See* St. George's Hospital Catalogue, series xi., case 4.

the question, and hot fomentations applied over conium, belladonna, or opium ointment, or turpentine stupes, should be substituted. At a still later period, blisters, iodine applications, or mercurial preparations are sometimes useful in promoting the absorption of inflammatory products.   Opium is the sheet-anchor in these cases, and should be given in half- or one-grain doses every three or four hours to an adult. In young subjects, and where the peritonitis is of the sthenic form, calomel in one-grain doses, combined with opium, should be given until the system is brought under its influence ; in some cases it affords great relief from meteorism.

Constipation should be left untreated for some days ; enemata are the best means of affording relief. The same great care should be employed with regard to diet as is requisite in all forms of peritonitis, so as to avoid any undue action of the intestinal muscular coats and abdominal muscles.

Anuria, when due to the shock of the accident, will pass off as soon as reaction is established. It should therefore for a time be treated on the expectant plan by warmth, gentle restoratives, and hot saline drinks. If it persists the kidney should be exposed through the loin and incised, unless the calyces or renal pelvis are already open. As anuria may be due to a ruptured single kidney or to the opposite kidney being also injured or previously diseased, it is a very unfavourable symptom. Schroeder, in a case of anuria in which the upper third of the kidney was detached, simply plugged the lumbar wound and the patient recovered.

Perinephric suppuration and nephrectasis. — If a renal or perinephric abscess, or nephrectasis—whether the distension of the renal cavity is by urine, pus, or blood—follows as a late result of an injury to the kidney, it should be treated on the principles laid down under those headings in other parts of this work. These are the cases in which aspiration was formerly tried.

The late Mr. J. F. West * of Birmingham removed by lumbar nephrectomy from a boy, fifteen years old, who had four months before received an abdominal injury, *a suppurating kidney*, which weighed sixteen ounces. Hæmaturia, a lumbar tumour, pus in the urine, and pyrexia, soon followed the injury. The aspirator was used a month afterwards, and fifty-five ounces of purulent fluid

* *Brit. Med. Journ.*, p. 669 (April 7th 1883).

were removed from the interior of the kidney ; this operation was repeated a week later, and was followed up by lumbar nephrotomy and drainage. As purulent ammoniacal fluid daily passed through the drain tube, and the patient was rapidly emaciating, nephrectomy was performed ; but the patient died (as I learnt from Mr. Jordan Lloyd) between two and three weeks afterwards from exhaustion and purulent infiltration into the retro-peritoneal connective tissue.

Another case in which aspiration was followed by lumbar incision, and at a still later period by lumbar nephrectomy, has been recorded by Mr. A. E. Barker in the *Lancet* (January 17th, 1885). A male child, aged three years and eight months, had been run over by a hansom. It would seem that the pelvis of the kidney had been lacerated by the transit of the cab wheel, and that *urine had escaped into the circumrenal tissue, and there formed an encysted collection of urine and pus.*

A case very similar in character to the above, which yielded to aspiration and to the treatment of simple perinephritis, had been previously published by Mr. Bennett May, in the *British Medical Journal* (January 20th, 1883).

In Marshall's case, reported in 1883,* aspiration and drainage through a cannula was followed by the patient's recovery, but whether with a permanent fistula, or not, is not recorded. A girl of thirteen was knocked down and run over ; a swelling which occupied the left lumbar region and left half of the abdomen was aspirated and five ounces of a yellow-brown odourless fluid were drawn off, which when heated emitted a strong urinous odour and yielded a heavy flocculent albuminous precipitate. It contained ·55 per cent. of urea. Subsequently, a large trocar and cannula were introduced and thirty-six fluid ounces of chocolate-coloured fluid, similar in character to that before obtained, were withdrawn. A drainage tube was inserted, and a profuse discharge of a similar fluid, and later the escape of pus and once a gush of clear urine-like fluid, occurred. The patient left the hospital with a superficial wound thirteen months after the accident and five months after her admission. It is pretty certain that

---

* *Lancet ;* and *Brit. Med. Journ.*, May 26th, 1883 ; and *Roy. Med.-Chir. Trans.*, vol. lxvi., p. 311.

in this case—as it is in others where *urine escapes into the cellular tissue*—either the renal pelvis was ruptured or a calyx is laid open, and that the extravasated urine comes from the cavity of the kidney, not from the torn renal substance. It would seem from Sir Spencer Wells' case already referred to, as well as from operation wounds and numerous instances of lacerated kidney, that the torn renal surface is not capable of secreting urine at all, or, at any rate, not in sufficient quantity to give any of the characters of urine to the fluid contents of a tumour in contact with the kidney.

Mr. Croft * describes a case diagnosed as traumatic hydro-nephrosis in a boy, aged twelve years, who, on June 3rd, 1880, fell and hurt his left side and loin. The tumour was tapped eight times. Between three and four pints of much the same kind of fluid were drawn off each time, except that on the last occasion it contained a very large amount of albumen. From this time no swelling recurred, and ten months afterwards the boy remained in a " cured " condition. Mr. Croft explains the case by supposing that at the time of the accident a lesion (but not a complete rupture) of the pelvis of the kidney near its junction with the ureter occurred, and that adhesive inflammation, and, as a consequence, complete obliteration of the lumen of the upper end of the ureter, followed. The cure was obtained, he thinks, by the entire atrophy of the kidney and the contraction of the hydro-nephrotic cyst.

In one of the two well-known cases recorded by Mr. Stanley † the injury may have been (probably was) of the same character as that in Barker's, Bennett May's, and Marshall's cases. This patient also was a boy, who developed a large swelling in the right side six weeks after an injury. No symptoms of drowsiness or uræmia were observed. Upwards of fifty ounces of urinous fluid were drawn off through a cannula ; and at intervals, ranging from eleven days to three months, the tapping was repeated, and the same kind of fluid was withdrawn. At the last tapping only six ounces came away ; the tumour slowly diminished, and at the end of nine months the patient left the hospital with a swelling which

* *Clin. Soc. Trans.* vol. xiv., p. 107.

† *Trans. Med.-Chir. Society*, vol. xxvii.   *See* also the chapters on Injuries of ·Ureter, Vol. II., p. 330 *et seq.*

still fluctuated. The final termination of the case is not known. Bennett May's and Marshall's, and Croft's, cases show that an accumulation of urine in the loin, either outside or inside the cavity of the kidney, in consequence of an injury, may be entirely and permanently got rid of by the use of the aspirator.

Dr. R. F. Weir* reported a case of injury to the kidney followed by an abscess within the substance of the organ, which was treated successfully by nephrotomy and drainage.

The following case shows that recovery may sometimes occur spontaneously after injury to the kidney attended with severe hæmaturia.† What the ultimate result to the kidney is after such an injury it is, of course, impossible to say.   A cavalry soldier whilst dressing his horse received a kick in the lumbar region ; some time afterwards he fainted, and only rallied after he was carried to his room. Very soon afterwards there was a large ecchymosis where he was kicked ; there was little manifest pain ; the respirations were impeded, and the pulse was small, hard, and frequent.   He was bled immediately.   Within four hours from the accident his condition was much worse, the abdomen was tympanitic, tender, and very painful, his respirations were very difficult, fever had commenced, and no urine had been passed. He was bled a second time, and more freely than the first. During the night he was horribly tormented by a desire to urinate, but without capacity to do so.   The next morning the bladder was found considerably distended ; a catheter was introduced and a large quantity of urine, at first of natural colour, but quickly becoming bloody, was evacuated.   He was at once much relieved ; but a quarter of an hour after the use of the catheter he perceived a trickling of blood, which lasted during an entire hour, and gave him much comfort.   The fever, pain, and tumour of the abdomen entirely disappeared, the respirations became easy, and two hours afterwards the urine was discharged naturally.   Hæmaturia persisted during three consecutive days at intervals more or less prolonged ; on the sixth day there only remained a slight pain in the lumbar region.   On the fifteenth day he was able to walk about, and on the twenty-fifth day he was discharged.

* *New York Med. Journ.,* Dec. 27, 1884.
† Aran," Essai sur l'Hématurie," 1811.   Quoted by Rayer, vol. i., p. 278.

Operative and non-operative treatment of subparietal injuries contrasted.—As showing the different results in reference to operative treatment the following figures are of value:—

Of twenty-six cases collected from English and American sources in the ten years 1884 to 1893 inclusive, fourteen were treated palliatively, of whom ten died and four recovered, *i.e.* 70·7 per cent. died. Eleven were treated by operation of some kind, of whom eight recovered and three died, *i.e.* 27·2 per cent. died. The nature of the operations performed in the eleven cases were, three nephrectomies (one abdominal, two lumbar), with two deaths, one of the lumbar operations being successful ; six cases of lumbar incision for extravasated blood and urine (one not until six months after the injury, and in this case a small fistula remained), with *five* recoveries and one death ; one partial nephrectomy with recovery ; one lumbar nephrectomy after a preliminary exploratory laparotomy, with recovery. One patient, whose case I have not included in the above analysis, died after cystotomy performed on a wrong diagnosis.

It is pretty clear from a perusal of the reports of cases, that more lives might be saved if timely operations were judiciously performed. It is to be feared that besides the cases which might have been saved, some of those which were operated upon ended fatally because the operation was too long delayed. On the other hand, whilst some of the injuries for which no operation is performed are, no doubt, very slight ones, we must not lose sight of the fact that others are among the most severe, the patients dying within a few hours of the injury from shock and hæmorrhage, and being too ill from the first to allow of any surgical operation being undertaken with any reasonable prospect of success.

The argument is, I think, fallacious which assumes that the cases which have been operated upon are the most severe, and those not operated upon are the slighter injuries; and so also is the conclusion that if many of those treated palliatively had been operated upon, the mortality would have been very materially further reduced. It must be admitted that the expectant plan is of necessity adopted in some of the very severest as well as in the very slightest cases.

CHAPTER VI.

INJURIES OF THE KIDNEY (*Continued*).

B.—Incised and Punctured Wounds of the Kidney.

1.—without protrusion of the organ.

Causes. — Wounds of the kidney in civil practice at least are very rare ; and in warfare uncomplicated wounds of the kidney are not less so. Otis tells us that no instance was reported during the American War, 1861–1865. Of forty-three cases collected by Küster,* six only occurred in females, and two resulted from lance and bayonet wounds in warfare. Keen tabulated eight cases of wounds of the kidney inflicted by other weapons than firearms : of these, five were stabs made by a knife, one by a pair of shears, one by a fall upon a pair of scissors, and one by a fall upon a pointed stick.

Edler † gives twelve cases, in five of which the wounds were produced by knife thrust, one by a dagger, and the others by rapier, yataghan, lance, sword and scythe. In two other cases recorded below (pp. 212, 213) the wound was caused by a fall upon railings and the consequent impaling of the loin. They differ widely from one another, according to the nature of the weapon with which they are inflicted ; as to whether they involve the cortex only, or penetrate to the tubular or pelvic portions of the organ ; and, again, as to whether they do or do not implicate the peritoneum or large blood-vessels of the kidney. From the anatomical position of the kidney, penetrating wounds like subparietal ruptures of this viscus may be of two chief classes : (1) those inflicted upon the posterior surface and in which the peritoneum is not involved ; and (2) those affecting the front surface and involving the peritoneum and very probably some of the other viscera as well.

* *Deutsche Chirurgie*, 1896.
† *Arch. f. klin. Chir.*, 1887.

Symptoms.—A wound of the kidney will be indicated by the situation, direction, depth, and immediate consequences of the injury; except in such a rare case as that recorded by Murphy, where a man fell on the handle of a hay-fork, which entered the rectum and, penetrating the colon, crushed the upper pole of the left kidney.

Pain.—As a rule injury is followed at once by more or less acute pain in the renal region. This is frequently due to the injury of the skin and soft parts rather than of the kidney. In most cases the pain is severe; in some it has been described as excruciating; while in a few it seems to have been slight, or altogether wanting. Hence Hunter speaks of the " sensation " as being " trifling "; and John Bell says, " The patient will be easy and his belly soft for some days, till the blood, coagulating, excites inflammation." The pain is not always confined to the renal region, but extends frequently along the ureter, to the testicle, and even to the corresponding thigh. This is especially the case when blood-clots are being passed along the ureter. Occasionally there is retraction of the testicle, or spasmodic contractions of the scrotum may be noticed.

Escape of urine.—Another early symptom is the escape of blood, or blood and urine, from the wound when the injury is behind the peritoneum. If the kidney is wounded superficially and the cortical substance alone affected, blood may appear externally; or be poured out into the circumrenal cellular tissue; or escape into the peritoneal cavity if the injury has been inflicted from the front, or the peritoneum has been reached and transfixed from behind. If the wound of the kidney is deep and the calyces or renal pelvis opened, urine as well as blood may escape from the external opening; or be extravasated into the retro-peritoneal tissue, or peritoneal cavity. *Urine is not likely to issue forth unless a calyx or the renal pelvis has been penetrated.*

Hæmaturia may or may not be an early symptom. If the cortex only is wounded, hæmaturia will not necessarily occur at all. In the following fatal case* no hæmaturia occurred. A woman, aged twenty-eight, on December 27th, 1894, fell on a butcher's knife and subsequently wandered about for four days before coming under

---

* Gaylord, *Medical News*, Philadelphia, 1895, vol. lxvi., pp. 402-4 : " A Case of Incised Wound of the Peritoneal Surface of the Kidney."

observation. A wound two and a half inches long was situated close to the eleventh rib on the right, and this side of the abdomen was dull on percussion, as far as the pelvis and to within two inches of the umbilicus, the rest being tympanitic. The urine contained 20 per cent. of albumen. There was general anasarca, and also some pneumonia at the base of the right lung. Next day she aborted of a five months' fœtus. On January 6th the dulness had extended to the fourth rib and centrally to the umbilicus, a mass occupying the right iliac fossa. Death occurred suddenly. There was a lacerated wound on the anterior surface of the right kidney 5 cm. long, extending downwards and out-wards, with a large hæmatoma. No hæmaturia occurred, and there was no sign of repair in the kidney.

When the cavity of the kidney has been opened it is most likely that the fact will be declared very quickly after the injury, as urine more or less stained with blood, or even pure blood, may be passed freely within a few minutes *per urethram*. On the other hand, dysuria, or urgent and frequent desire to mic-turate without the ability to do so, may be a leading feature ; the discharge of urine along the ureter into the bladder, or along the urethra from the bladder, being prevented or rendered difficult by the impaction of blood-clot either in the ureter, the urethra, or at the neck of the bladder.

When hæmaturia occurs, it may set in at any time from a few minutes to a few days, though usually it commences within a few hours ; it may last for only a day or two or extend over several days ; it may be slight, and sufficient merely to stain the urine, or it may be profuse and rapidly fatal.

In some cases so much blood is effused into the surrounding tissues and peritoneum, and is thus drawn away from the kidney so rapidly, that none traverses the ureter to the bladder, even though the wound opens the renal cavity. This was proved to have been the case in an instance given by Morgagni.* A man, aged twenty, was stabbed on March 24th, 1742, and rapidly died from internal hæmorrhage. The knife had entered the right cavity of the thorax between the ninth and tenth ribs, and after piercing the diaphragm close by these ribs and penetrating the adjacent part of the liver, it passed through

* Morgagni, Letter liii., s. 40.

the right kidney obliquely from the anterior to the posterior
surface and wounded the muscles by the side of the spinal column
beyond.   No very large blood-vessel was wounded, but an
enormous quantity of blood was poured out into the peritoneal
cavity.   *The bladder contained a small quantity of urine unstained
by blood.*

To the above symptoms others must be added as occurring
shortly after the infliction of a severe wound.   Nausea and
vomiting, pain in the epigastrium, muscular spasms, and rigidity
of the abdominal parietes on the side injured ; fainting fits ;
a small pulse, rapidly becoming feebler, irregular, and more and
more rapid ;   coldness of the skin ;   restlessness ;   and intense
anxiety of features, all indicate considerable shock and more or
less loss of blood.   If the peritoneum is wounded and urine
escapes into its cavity, traumatic peritonitis will soon declare
itself.   If the wound does not involve the peritoneum, peritonitis
may come on at a later period by extension of inflammation
from the retro-peritoneal cellular tissue.   When a penetrating
wound is not fatal within a few days, inflammation more or
less severe and widespread must be looked for ;   in the old-
fashioned gun-shot wounds it was inevitable, with the modern
bullet and in clean punctured or incised wounds it may
possibly be escaped.   During the course of the inflammation
there is abdominal distension and pain, a dry hot skin, a parched
tongue, red at its edges and furred in the centre, and a high
temperature with a rapid pulse.   Rigors sometimes mark the
commencement and continuance of suppuration.   Should the
inflammation involve the kidney itself, the symptoms of nephritis
or pyelitis will arise, and pus in the urine from inflammation
of the renal pelvis will then most likely be found.

When the inflammation commences in the retro-peritoneal
cellular tissue, perinephritis and perinephric abscess present them-
selves in the various aspects and with the several tendencies described
under those heads.   There may form outside the peritoneum,
after some hours or days, a dull swelling due to the accumulation
of blood, or of blood and urine ;   and at a still later period retro-
peritoneal suppuration may give rise to just the same kind of
hardness and swelling as extravasated blood or urine.   Subse-
quently in each case the peritoneum may become inflamed owing

to its being stretched and irritated ; and death from peritonitis in this way sometimes occurs.

Retention of urine, which has been known to last for four, five, or six days and longer, and then to be followed by the passage of bloody urine and blood-clots, has in some cases of punctured wounds been a striking feature.

There is the utmost uncertainty as to whether, after an injury to the kidney, there will be simple retention of urine, or dysuria with frequency of micturition, or retention with frequent painful and fruitless efforts to micturate.

When lumbar pain and swelling are accompanied by fever, and followed by vomiting, abdominal distension, restlessness, anxiety, and hiccup, then there are what John Bell called " the torments of the *miserere mei*," and death is not far off.

Diagnosis.—In some cases the evidence of a wound of the kidney has been full and complete from the first ; in others it has only been obtained after some of the remoter effects of such wounds have had time to show themselves ; in others, again, the diagnosis has remained uncertain throughout ; and, lastly, in some fatal cases of abdominal wounds the injury to the kidney has only been thought of when actually seen on the post-mortem table.

When urine, or a fluid having a strongly urinous odour, escapes by the external wound, the diagnosis cannot be uncertain. Hæmaturia and pain in the renal region coming on *at once* after a wound in the loin, are very strong reasons for diagnosing wound of the kidney. If the hæmaturia follows almost immediately after the injury, and especially if there is a considerable quantity of blood voided *per urethram*, the evidence amounts almost to proof. Hæmaturia has been noted in the larger proportion of cases, and is so fairly constant a symptom that it ought to cause suspicion in cases where there is neither dysuria nor escape of urine by the wound, nor any evidence of urinary extravasation.

When traumatic peritonitis occurs, and hæmaturia exists or has just previously existed, attention should be at once directed to the kidney.

It must be borne in mind, however, that the kidney may be wounded, and its pelvis actually transfixed, without hæmaturia

occurring; whilst hæmaturia may follow a wound which does not implicate the kidney.

Probably, did the patient live, some amount of hæmaturia would, sooner or later, be seen in every case in which a calyx or the renal pelvis was entered, provided the ureter did not become blocked by clot or foreign body. As a consequence of traumatic *perinephritis*, the loin may be the seat of pain, the kidney may become inflamed, and the urine may be charged with blood; so that pain and hæmaturia conjoined, when coming on *a day or two after a wound* in the renal region, are by no means absolute signs of a wound of the kidney. In other words, inflammation of the kidney, attended by pain and hæmaturia, may occur as a result of a wound in the renal region which, however, does not directly involve the kidney itself.

The situation, direction, and depth of the wound; a comparison of the wound with the weapon; and the respective attitudes of the patient and of the assailant at the moment when the wound was inflicted, may assist in guiding to a right diagnosis. Taken by themselves, apart from the symptoms, they cannot, however, be relied upon.

A digital exploration of the wound will, in some cases, make the diagnosis quite clear as to whether the kidney is or is not wounded.

To repeat; it may be stated (1) that a wound in the renal region followed by the escape of urine through the wound is conclusive of injury of the kidney; (2) that such a wound quickly followed by the discharge *per urethram* of urine heavily mixed with blood, or of pure blood, is almost conclusive, if not quite so; (3) that such a wound followed by retention of urine or lumbar or abdominal pain and dysuria, even without hæmaturia, is highly suggestive of a superficial wound of the kidney, or of a deeper wound and the blockage of the ureter; (4) that hæmaturia followed by traumatic peritonitis is strong evidence of an injured kidney.

Pathology.—The lesions which have been found after death in cases of wounded kidney have varied with the length of time the person has lived after being wounded, and with the nature of the weapon wherewith the wound has been inflicted.

Only one kidney is as a rule implicated. Foreign bodies are

not apt to be carried into the wound, as is the case in gunshot wounds, nor are other organs involved unless the wound is inflicted from the front or side of the body, which is rare, or in such an accident as that of Murphy's (p. 200), which is altogether exceptional. The wound may involve the renal substance only, or the renal pelvis, or the vessels at the hilum. The edges of an incised wound may be smooth and sharp; if inflicted with a blunt instrument, they will be lacerated; and all gradations in size are met with, from a fine puncture to a cut as wide as the hand.

Wounds reaching the kidney from the loin may open the pelvis of the organ, but do not commonly penetrate to the peritoneum.

When the external wound is large and direct, blood and urine escape freely; on the other hand, when there is only a small opening and the soft parts are penetrated obliquely, they fall together, and internal extravasation may occur, much as in subparietal injury.

Narrow aseptic wounds of the kidney close by organisation of blood-clot, and leave only a fine pigmented scar; larger ones close more slowly and with granulation, leaving a larger scar. If the abdominal cavity is penetrated a fistula may possibly ensue, the walls of which will be formed by adhesions of the abdominal viscera. Septic injuries of the kidney through the lung and pleura result in empyema, whilst aseptic penetration may cause only limited adhesion.

Garengeot and Dumont the younger report cases fatal from incised penetrating wounds involving the renal vein.

When the patient has lived several days a perinephric abscess may form; and the kidney has been found more or less disintegrated, with merely a semi-liquid pulp in the midst of the inflammatory or suppurating changes of perinephritis. The kidney in some cases has been reduced to a mere abscess sac; or part of it has been suppurating, and the rest has had a pale pink colour, and a granular, softened, and flabby consistence.

The renal pelvis is not very unfrequently the seat of active suppurative changes, and may present greenish, sloughy, or ulcerated patches; blood may be mixed with the pus, and the vessels of the mucous membrane may be much distended.

When the ureter has become permanently blocked by blood clot, foreign body, or adhesive inflammatory changes, the kidney undergoes those pathological changes which are productive of either hydro-nephrosis, pyo-nephrosis, or granular degeneration and atrophy.

Death from causes unconnected with the kidney has rendered it possible to prove the complete cicatrisation of wounds of the kidney.

The length of time required for the repair of a wound of this organ varies, no doubt, with the character of the wound. Probably some few days pass before repair commences. In the New York Hospital Museum is a specimen (No. 749) showing a deep punctured wound of the convex border of the kidney, not involving the pelvis. The patient died five days after the lesion from other injuries. There had been no attempt at repair.

Prognosis.—" Servari non potest cui renes vulnerati sunt," says Celsus ; but this is far too sweeping ; for though serious, wounds of the kidney are by no means necessarily mortal. Hennen says : " The slightest reflection on the situation and structure of the kidney, and on its various sympathies, will at once show the desperate nature of wounds inflicted on it, even with all the caution of a curative intention. The instances that I have observed where recovery has been established are very few indeed. If the patient has survived the first hæmorrhage, the fever and peritoneal inflammation with incessant hiccough and vomiting, and sympathy of the diaphragm and stomach, have generally cut him off ; and if he has for a time escaped, excruciating pains, profuse suppuration from fistulous sores, hectic, and emaciation have terminated his existence. Where the cure has been effected, there is reason to think that the ureter has been but slightly bruised, and the body of the kidney itself left untouched."

At the present day, however, we know, from the success that has attended recent surgical operations upon the kidney, that this estimate of the danger of renal wounds is altogether too unfavourable.

The prognosis in cases of incised and punctured wounds, involving the kidney only, is more favourable than if the peritoneum or some other organ as well as the kidney is implicated. Among twelve cases reported by Edler death ensued in five, the fatal issue being due

in two to primary and in two to secondary hæmorrhage, whilst the fifth succumbed after nephrectomy.

The post-mortem investigation in the fatal cases shows that injuries to the parenchyma are of comparatively trifling importance, being accompanied by only slight loss of blood and no extravasation of urine ; wounds of the pelvis, on the other hand, are associated with both in a very considerable degree, the main vessels in some cases being opened or entirely severed.

Persistent suppression of urine, whether due to severe damage to both kidneys or their vessels or to the destruction of a " solitary " or an " unsymmetrical" kidney, or merely to reflex inhibition of the renal function, is necessarily fatal.

Of the eight cases of punctured wounds tabulated by Keen, six recovered and two died, one of coma from suppression of urine on the second day after the injury, and one of abdominal sepsis and abscesses of the liver a month after the accident. In four of the cases nephrectomy was performed and all of them recovered ; in two of the four the nephrectomy was secondary after previous lumbar incision.

Küster records ten fatal cases out of forty-three such injuries, many with serious complications—a mortality of 23·25 per cent. The results in simple cases were still more favourable, as shown by the record of four deaths among thirty-one uncomplicated injuries, *i.e.* a percentage of 12·9, the causes of death being sepsis and hæmorrhage.

As evidence of the utility of surgical interference in these cases he quotes ten operations, including two primary and six secondary nephrectomies, one secondary loin incision, and one operation for the removal of a cyst, all of which were followed by recovery.

Moreover, several cases of recovery from accidental wounds were on record at dates long prior to modern surgery. Haller, Bourienne, Borthwick,* Fallopius, Valleriola, Schenckius, Heister, La Motte, Forest, and other old writers, have given instances of recovery from *incised and punctured wounds*.

The following cases of *incised and penetrating wounds* have also

* Hennen (*op. cit.*, p. 435) refers to the cases of these three observers. References to them and to others are given in the " History of the War of the American Rebellion," and by Rayer.

been reported as ending in recovery. The case of a butcher's boy, aged fourteen, is related by Knox, of Edinburgh, and by Schuster.* He had received a stab wound three inches deep, on the right side, immediately below the twelfth rib, three inches from the spine; considerable hæmorrhage followed; urine mixed with blood was passed for three days; on the seventh day there was slight icteric coloration of the skin; a copious light brown fluid, which proved to be urine, escaped from the wound; recovery in fifty days.

Bourienne † recites a case of bayonet wound in the side, penetrating the kidney; severe pain, vomiting, distension of the abdomen, and convulsive retraction of the testicle followed; on the second day blood passed *per urethram ;* recovery ensued in twenty-four days.

Purmann's case.—A soldier received a stab wound of the left kidney; retention of urine, finally bloody urine, which escaped with great force on the fifth day; complete recovery in six weeks.

Forest's case.—A youth of twenty, stabbed in the right kidney, had retention for six days; after hot fomentations he passed a quantity of bloody urine, with clots, and had a rapid convalescence.

Dupuy's case.—A man stabbed with a sharpened foil in the right lumbar region; had acute pain, and voided nearly pure blood from the urethra; acute circumscribed peritonitis and nephritis followed; he recovered under an energetic antiphlogistic treatment.

Sir A. Cooper mentions having seen a boy who was struck in the back with a penknife, and almost immediately wished to make water; on doing so, he passed a large quantity of blood. Hæmaturia continued for several days, but subsided on his remaining quiet in bed.

Mr. Ackerly, ‡ of Liverpool, relates the case of a man, aged thirty, who was wounded in two places by the open blades of a pair of tailor's shears, the one entering the abdomen about two inches above the anterior superior spinous process of the

---

* " History of the War of the American Rebellion," vol. ii., part ii., p. 162.

† *Journal de Med.- Chir. Phar.*, etc., Juillet à Decembre, 1774 ; vol. i., part xlii.

‡ " Observations on Wounds of the Abdomen," *Lond. Med. Gazette*, vol. xx., p. 549 (1837).

ilium, on the left side (from which wound about four inches of omentum protruded), the other entering near the spine, on the same side, just beneath the last rib. There were copious discharges of urine from the latter wound for two days. The omentum was cut away, and the bleeding vessels secured by ligatures. Recovery ensued in fourteen days.

Mr. J. Johnston* recorded a case of recovery, after an incised wound of the kidney, in a man aged thirty-two. The wound was inflicted with a large table-knife, with a blade of eight and a half inches, the whole of which penetrated the tissues. The peritoneal cavity was opened. Painful spasmodic retraction of the testicle was the prominent symptom, and led the man to suppose that he had been stabbed in the groin. There was much hæmorrhage from the wound, and within an hour after its infliction a pint of blood was passed by the urethra. Symptoms of peritonitis followed, and a perinephritic abscess had to be opened; quantities of urine escaped through the abscess opening. The patient made a good recovery in about six weeks, and it is to be inferred, though it is not stated, that a permanent urinary fistula was escaped.

Fourteen cases of recovery after incised or punctured wounds of the kidney were collected from various sources, and are referred to by the editor, Dr. Otis.† No instance of punctured or incised wound of the kidney was, however, known to have occurred in the War of the Rebellion.

The sources of danger from penetrating renal wounds are (1) hæmorrhage, if the great vessels of the organ are injured; (2) peritonitis, if the front surface of the organ or any of the adjacent viscera are penetrated; and (3) perinephritis and perinephric abscess, and effusions of blood or blood and urine behind the peritoneum. If the wound is inflicted upon the posterior surface, and neither peritoneum nor the great vessels at the hilum are wounded, recovery may be looked for. Indeed, it is not too much to say that whilst the kidney may recover from very considerable lesions, mere punctures or incisions of its substance are attended with a very small amount of risk.

* *Brit. Med. Journ.*, April 4th, 1857, p. 275.
† "Medical and Surgical History of the War of the American Rebellion," vol. ii., part ii.

Convalescence is in some cases prompt, in some it is completed only at the end of many months. A bad prognosis must be given when there is much extravasation, if a foreign body remains in the wound, or if the peritoneum has, been lacerated. Wounds of the trunks of the renal vessels are rapidly fatal. When shivering, fever, swelling, and the other signs of purulent infiltration into the cellular tissue, set in, the prognosis is bad, unless early and efficient vent can be given to the matter. Abscesses behind the peritoneum, if not opened and thoroughly drained, cause continued fever, sepsis, and death, after a long and exhausting illness. Nephritis, cystitis, and peritonitis are other causes of death.

Rayer, whose estimate on the whole of the dangers of renal wounds is by no means an exaggerated one, clearly attaches more importance to wounds of the calyces and pelvis of the kidney than to wounds of the surface of the organ. Though agreeing with Rayer in this opinion, yet I do not think experience justifies us in regarding the prognosis of simple wounds penetrating to the cavity of the kidney as unfavourable; certainly they are not to be classed in the same category of risk as wounds of the renal artery or vein.

Treatment.—Mild purgatives and emollient enemata are indicated if the bowels, especially the large bowels, are loaded, but after these have been once freed of their contents, the quieter they are kept the better. It is, however, very undesirable that a mass of hardened fæces should rest in the colon and act as a source of irritation to the neighbouring injured kidney.

The treatment of the wound cannot be too simple. It should be left open for drainage, unless it be a very large incised wound, in which case one or more deep sutures may be introduced to bring the edges together. Some antiseptic gauze, or a piece of lint soaked in carbolised oil, and over this a layer of absorbent cotton-wool, are the only dressings needed after the parts around, and the wound track, have been carefully cleansed and disinfected. If the wound is not aseptic, a drainage tube should be retained.

Unless its course be very oblique, it will rarely be necessary to enlarge the wound for the purpose of preventing infiltration of urine. If the opening externally is very small and its edges subsequently become œdematous, blood or urine may not be

able to escape readily from the tissues, and in such cases it is imperative to widen the wound as soon as possible. It may be needful, in order to arrest hæmorrhage or suture the kidney, to enlarge the wound. If this is done the kidney should be brought well into view for the purpose of examination, and the subsequent procedure will depend on the condition found. If the parenchyma is simply incised it should be sutured ; if the renal pelvis, and not the parenchyma, is opened by a clean cut wound it should be sutured as after the operation of pyelotomy. If the parenchyma is contused as well as punctured or incised, suturing the wounded surfaces together will be contra-indicated, and would not, in all probability, succeed even in controlling hæmorrhage ; under these circumstances, the wound should be packed with iodoform gauze, with the object of staying the bleeding and with the expectation that repair will take place in the wounded kidney. If a portion of the kidney has been cut completely off from the rest, it should be removed, and the cut surface of the main portion of the organ carefully examined for any large bleeding vessel. If there be any such it should be ligatured, or clamped by forceps which might be left *in situ;* but the ligature cut off short is the best. If a large branch of the main vessels of the kidney is divided or the kidney substance much lacerated, primary nephrectomy should be performed. If the peritoneum has been opened and blood or urine has escaped into the peritoneal cavity, laparotomy and antiseptic cleansing, and the removal of the clots and urine, may be requisite ; but it should be remembered that neither blood nor urine, if aseptic, causes trouble to the peritoneum.

A wound of the peritoneum with severe contusion or laceration, as well as a punctured or incised wound of the renal parenchyma, would be an additional reason for primary nephrectomy. If, however, the peritoneum has been opened but no blood or urine has escaped into it, the rent in the membrane should be sutured, and the damaged kidney treated on its merits as if the peritoneum had remained intact. Instead of suturing the peritoneum the wound has been plugged with iodoform gauze, as in the following case, recorded by F. Hartley in the New York Clinical Society, 1887. A man, aged twenty-five, was stabbed in the right side, the knife entering

between the ninth and tenth ribs, midway between the mammary and axillary lines, opened the peritoneum and traversed the right kidney from the outer to the inner margin. Hæmorrhage was profuse, and it was necessary to enlarge the wound to arrest it. The peritoneal wound was plugged with iodoform gauze and free exit given to the urinary discharge. Recovery occurred with a small urinary fistula, which persisted for six months while the patient was under observation.

If after some days there should be any indication of perinephritis and if the original wound, being small, has not already been enlarged, this should be done without waiting for the formation of pus. If a perinephric abscess has formed it should of course be laid freely open and drained; and if the kidney itself has shared in the inflammation of the surrounding tissue or become necrosed, or has independently of perinephritis become the seat of acute pyelitis or pyelo-nephritis, secondary nephrectomy should be performed. Wallis gives seven cases of nephrectomy for perforated or incised wounds, of which six recovered and one died. Keen quotes four cases (out of eight punctured wounds tabulated by him), in which nephrectomy was performed, twice as a primary, and twice as a secondary operation, and all the patients recovered.

The following are brief abstracts of some of the published cases of incised and punctured wounds—two of which (Cheever's and Gage's cases) are included in Keen's list—which have been treated by nephrectomy :—

In the *Medical Society's Reports* for 1896, F. S. Edwards narrates the case of a man, J. M., aged fifty-five, who fell from a third floor on to some railings, one of which penetrated his side, broke off, and was extracted by a policeman. When seen he was suffering from shock and hæmorrhage from a wound in the left loin, with hæmaturia. There was a deep contused and lacerated wound extending from the lowest two ribs, which were comminuted, to the anterior superior iliac spine, and hæmorrhage was proceeding from the kidney, which was exposed at the bottom of the wound, the organ being lacerated both longitudinally and transversely into the hilum. Nephrectomy was performed and was followed by suppuration and fever, but with ultimate recovery. The amount of urine increased regularly in five days from 22 to 50 ounces, the urea being estimated at 473 grains.

In the *Clinical Society's Reports* for the following year, 1897 (vol. xxx., p. 44), Wallis reports the case of a man, twenty-two years of age, who met with a similar accident, falling from a ladder and being impaled on spiked railings. The wound was situated below the tenth costal cartilage on the right side, and was $1\frac{1}{4}$ inches long. A pint of blood was passed by the urethra. The kidney, which was torn nearly in two, was at once removed, and the peritoneal cavity cleansed. Healing occurred at once and recovery was rapid. The author gives a summary of twenty-one cases of nephrectomy for injury of the kidney, fourteen being subcutaneous lacerations, with nine recoveries and five deaths; and seven perforated or incised wounds, with six recoveries. In one recorded by West in the *British Medical Journal* (1883), the result was not stated.

In Cheever's case a man, G. C., aged twenty-five, was stabbed in the right loin with a pair of shears. Hæmorrhage from the wound with hæmaturia, accompanied by clots and pain at the neck of the bladder and end of the penis, occurred. Lumbar nephrectomy was performed ten days afterwards, and a large amount of coagulum was removed from the outer capsule. The kidney wound was stellate, $1\frac{1}{2}$ cm. in diameter, and, penetrating the nearest calyx and the pelvis, passed completely through the organ. The patient was discharged thirty-two days after the operation.

H. Gage, in the *Boston Medical and Surgical Journal* (vol. i., 1891) records the case of a girl, aged twelve, who received a wound in the right lumbar region from a small pair of shears while stooping. The wound was 1 inch long and situated just below the twelfth rib. Hæmaturia occurred the same evening and continued with intermissions for sixteen days, being very profuse and attended with the discharge of clots. During the thirteen or fourteen days while the urine was clear there was pain, with the development of a tumour in the loin, which disappeared with the recurrence of hæmaturia on the fifteenth day. The tumour was due to the plugging of the ureter with clot and to the extravasation of blood into the circumrenal tissues, the patient suffering at this time from anæmia with frequency of micturition and tenesmus. Lumbar nephrectomy was performed. The tissues were found infiltrated with blood and urine, and

the ureter was distended and blocked with clot. The shears had passed completely through the kidney a little below the centre, crossing the pelvis and severing a large branch of the renal artery before emerging through the capsule on the anterior aspect.

A remarkable case of recovery after left lumbar nephrectomy and resection of a prolapsed portion of the left lung is recorded by Demons.* A mechanic, forty-nine years of age, was wounded by a knife in a fight; the wound was 4 cm. long in the left side of the thorax, between the ninth and tenth ribs, through which protruded a piece of the lung as large as a fist; there were other symptoms pointing to wound of the left kidney, hæmaturia, vomiting, and pain and swelling in the left side. The prolapsed portion of lung was resected at the end of a week, but no improvement followed, and pus and urine exuded from the wound in the thoracic wall. Abscesses formed around the wound, and the patient continued to get worse till lumbar nephrectomy was performed, after which he at once began to improve, and ultimately got quite well.

Cases are recorded in the *British Medical Journal* of November 18th and November 25th, 1899, by Bland-Sutton, Turner, and Swinford Edwards, in which primary abdominal nephrectomy was performed for ruptured kidney. Though this method is recommended by these surgeons, it ought, in my own opinion, only to be followed in cases in which there is doubt as to the organ injured, or as to whether there is an injury to some other abdominal organ as well, or where there is reason to think blood is escaping into the peritoneal cavity.

B.—Incised and Punctured Wounds (*continued*).

2.—WITH PROLAPSE OF THE INJURED OR UNINJURED KIDNEY THROUGH THE EXTERNAL WOUND.

The kidney may be prolapsed through a wound either in the back or on the front of the abdomen. When through a posterior wound the peritoneum is not necessarily injured.

The prolapsed kidney may be either injured or uninjured. The prolapse may take place primarily, that is, at the time of the infliction of the parietal wound; or secondarily, that is, some time

* *Bull. et Mém. Soc. de Chirurgie de Paris*, 1886, n.s. xii., pp. 450–455.

after the infliction of the wound as the consequence of coughing, sneezing, or some other sudden or considerable muscular effort. It may be caused by a deep spasmodic inspiration accompanying a violent or unexpected injury, or by the withdrawal of the weapon, or it may even be due to the effort of rising. The forcible contraction of the diaphragm and abdominal muscles may very easily displace the kidney from its loose attachments and cause it to protrude as soon as the resistance of the lumbar muscles is withdrawn.

The wound through which the prolapsed organ appears may be inflicted by any cutting, lacerating, or penetrating instrument, or it may be a result of gun-shot injury.

Symptoms.—Besides the evidence of the protruded organ, there may be hæmaturia whether the kidney is wounded or not, and there may be discharge of blood or urine, or both, from the protruded organ if it be wounded as well as protruded.

Hæmorrhage naturally occurs from a wounded kidney whilst it is prolapsed unless the vessels are twisted or compressed by the lips of the parietal wound (*see* case 2, p. 218). Compression of the emulgent vein causes congestion and swelling of the kidney, as is constantly seen in the operating theatre, if the renal artery is not under control. If the protruded kidney is not soon returned into the body, and the congestion thereby relieved, hæmorrhagic infarction and necrosis will follow, as in Cartwright's case (*see* p. 218).

Otis gives the case of a man who fell backwards upon a scythe, which caused an incision $4\frac{1}{2}$ inches long, through which the right kidney, slightly wounded, protruded. The kidney was returned, and ice applied; bloody urine was passed *per urethram* during eight days; the patient recovered completely.*

The prolapse may be only partial, *i.e.* only one end of the kidney may protrude. Mr. Vernon † recorded the case of W. M., aged fourteen, who fell from a height of forty feet and received a wound of the soft parts immediately above the right iliac crest, through which protruded the lower end of the right kidney; a piece of its substance had been chipped out, leaving a gap which would admit the finger end; tenderness of the abdomen,

* Beck, *Chirurgie der Schussverletzungen*, s. 543 (1872).
  St. Bart.'s Hosp. Reports, p. 124 (1866).

discharge of small quantities of blood-stained urine by the urethra, and free discharge of urine from the wound were followed by recovery in eight weeks.

In such a case as Mr. Vernon's it is to be expected that the quantity of urine discharged through the wound would be very profuse and extend over a considerable number of days. The gap in the kidney in question, which admitted the end of the finger, extended, there can be no doubt, into the cavity of the organ, and this is the condition which, as was stated in the last chapter, is favourable to urinary extravasation; whereas a rent or actual rupture, which does not open up the calyces or pelvis of the kidney, will give issue to but a small amount, if any, of urine.

The older surgeons, I think, knew this; and, perhaps, John Bell* had it in his mind when he wrote : " If an intestine be wounded it pours out its fæces into the abdomen ; if the liver, spleen, or kidney be wounded, *these pour out blood ;* if the bladder, then urine filters into the cavity of the belly."

A kidney which has once been protruded may readily protrude again before the wound is closed, and it has been said it may become movable, but from my experience of renal explorations, in nearly every one of which I take the kidney out on to the loin and replace it, I should say that there is nothing more unlikely to happen to it.

Treatment.—This consists in—

(1) The replacement of the kidney after arresting hæmorrhage and cleansing and closing rents in its substance, if it be not injured beyond repair.

(2) Fixing the kidney in its place by silk sutures has been recommended, but can hardly ever be requisite, and would be likely to cause a temporary fistula if the wound were not throughout absolutely aseptic.

(3) The closure of the parietal wound, if recent, by deep silk stitches, if it is aseptic or can be made so. If not, the wound should be in great part closed and a free opening maintained for drainage. In an old wound it may be better to tampon till the kidney is adherent and then close with deep sutures.

* " On Wounds," p. 311 (3rd ed.).

In any case, if the protruding kidney is not completely broken up or too severely contused, and if the source of the hæmorrhage is not a large branch of the renal artery or vein, and the bleeding can be controlled without securing either of the main trunks, the organ ought to be replaced, after it has been cleansed, in a person of young or middle age and of good constitution.

The repeated successes of nephro-lithotomy have proved that recovery without a urinary fistula readily takes place after wounds of the kidney, whether the secreting substance of the organ is but slightly wounded and the calculus removed from an encysted space within it ; or is deliberately broken into with the finger-tip so as to open up a calyx ; or is left altogether untouched, and the renal pelvis instead of the secreting tissue is the part opened. The only difference seems to be, not in the certainty of recovery, but in the greater or less quantity of urine which escapes from the wound, and the longer or shorter duration of the urinary discharge. The smaller the opening into the cavity of the kidney, whether that opening be made directly into the renal pelvis or through the secreting substance into a calyx, the less the amount and the shorter the duration of the flow of the urine by the wound.

Even if a portion of the prolapsed kidney should be entirely broken off, the bulk of the organ—provided it is not much bruised, that it is still connected with its pelvis and ureter, and that the main blood-vessels are uninjured—should be replaced with the fair expectation that the patient will recover and that the remnant of the kidney will be of great future use.

Nephrectomy has been successfully performed in at least three cases. Two cases of stab wound, with hernial protrusion of a kidney through the wound, *and its subsequent extirpation*, are quoted by Dr. L. S. Pilcher.* Briefly stated, they are as follows : (1) Stephen P., aged twenty-five years, was stabbed with a bread-knife half an inch wide in the left hypochondrium on June 3rd, 1873 ; two or three hours after cough set in, which caused the kidney to protrude through the wound. At the end of twenty-four hours he presented himself at the clinic of Professor

* Pilcher : *Annals of the Anatomical and Surgical Society*, vol. i., p. 51 1878–9. Barker, in *Medico-Chir. Trans.*, vol. lxiii., p. 185, also gives abstracts of this and the next case.

Brandt,* in Klausenberg, having a pulse of eighty, a temperature nearly normal, and able to walk to a gallery to be photographed. On the fourth day after being wounded the kidney was drawn out and severed from its connections, after its pedicle had been igated.   Rapid recovery resulted.   At no time did the patient show symptoms of uræmia or peritonitis.   The quantity of urine secreted increased daily while he was under observation.   Twenty days after the injury the patient left the hospital, and was able to work as before.

(2) In January, 1875, an Arab girl,† of about fifteen years of age, was stabbed with a knife in the loin ; the right kidney was wounded, and was forced out of the abdomen between the lips of the wound, by which it was partially strangulated ; a ligature was thrown round the pedicle formed by the vessels and ureter, and gradually tightened ; at the end of six weeks the very slight pedicle still remaining was cut through and the organ was removed.   The girl made a rapid recovery, and subsequently remained in perfect health.

In the third case, Cartwright's,‡ a Chinaman had received a stab wound in the loin from which the kidney protruded.   It had been treated with bird dung and saliva and was in a state of putrefaction when seen by the surgeon, who applied a ligature to the pedicle and removed the kidney.   The patient smoked two pipes of opium during the operation and then walked away.   He returned in two weeks well.

* *See*, for fuller account, *Wiener Med. Wochenschrift*, 1873.

† Marvaud, *Recueil de Mém. de Méd., de Chirurg.*, etc., vol. xxxi. p. 502 (1875).

‡ *Lancet*, 1880, vol. i., p. 403.

CHAPTER VII.

INJURIES OF THE KIDNEY (*Continued*).

C. GUN-SHOT WOUNDS.

OWING to the penetrating character of gun-shot wounds it seldom happens that in these injuries the kidney suffers alone. Either the projectile reaches the kidney from the front after first damaging the intervening abdominal organs, or else, being discharged from behind or laterally, it traverses the kidney and passes on to penetrate the abdomen or spine. This is especially true of the projectiles of comparatively large size and high velocity employed in modern warfare. Exception may be claimed for the injuries caused by small arms which occur for the most part in civil practice.

The frequency of gun-shot wounds of the kidney as compared with similar injuries to other parts of the body, in military practice, is represented by Edler* as ·12 per cent.; this estimate exactly corresponding with that of Küster† for injuries of the kidney from all causes in civil life, as compared with accidental injury, also from all causes, to other parts.

From observations on kidney injuries in various campaigns by Demme, Serrier, Fischer, and Barnes and Otis, since 1859, it is estimated that these organs suffer in about 7·3 per cent. of penetrating abdominal wounds, and in 3·6 per cent. of all abdominal wounds. Abdominal gun-shot injuries in which the cavity is opened constitute just about 50 per cent. of all wounds of the abdomen due to this cause.

The cases on which our knowledge is chiefly based are eighty-five described by Otis in the American Civil War, fifteen in the Health Report on the Franco-German War, and fifty collected from older wars and various sources, and quoted by Edler in

* Edler, L. *Arch. f. Klin. Chir.*, Bd. xxxiv., s. 379.

† Küster, *Deutsche Chirurgie*, Lieferung, 52*b*. 1 Hälfte, Stuttgart (1896).

his "Dissertation on Injuries of the Kidney," 1887. In addition to
these, nineteen cases have been collected and published by Keen
of Philadelphia in the *Annals of Surgery*, 1896.

With regard to the distribution of this form of injury as to
sex, only three cases are on record in women, two accidental and
one suicidal. They are reported by Bardeleben, Keen and Price.

Pathology.—When a bullet strikes the kidney, according
to the degree of penetrating power it possesses, it either remains
in the parenchyma, opens up the cavity of the pelvis, or passes
right through the organ. As to the degree of injury inflicted,
there may be more or less damage to the renal substance; an
end may be separated; or there may be a clean perforation, the
walls of which are lined with a blackened eschar; or the organ
may be divided into two, as in Bloch's case; or it may be
converted into a mere pulp.

The passage of a bullet causes contusion and laceration for
some little distance around its line of transit. It has been shown
experimentally that a flaccid kidney presents a stellate laceration,
while one in which the vessels or pelvis are distended bursts
or splits widely when struck by a bullet.

Communication between the track of the bullet and the tissues
is shut off at first by the eschar, which intervenes; this separates
in from five to twelve days, accompanied by suppuration and
sometimes by the escape of urine, gas, or blood, due to the injuries
of other organs. Severe hæmorrhage is unusual at first, but
there may be considerable infiltration of blood into the outer
capsule and surrounding tissues. The pelvis or ureter is rarely
occluded by clot. Adhesion of the organ to its capsule may be
very tough.

The bullet, or a piece of bone or other foreign body carried in
with the bullet may remain in the kidney, and either become
encysted or set up septic inflammation; or may pass out by the
ureter or the wound with the urine.

It may be the cause of a persistent fistula or become the
nucleus of a calculus, as recorded by Stromeyer; or it may cause
suppurative nephritis and perinephritis.

We learn from the History of the American Civil War* that
gun-shot wounds of the kidney, are often associated with wounds

* "War of the American Rebellion," part ii., vol. ii.

of the stomach, spleen, liver, diaphragm, intestines, or spine. Such cases are usually speedily fatal from shock, or shock and hæmorrhage conjoined. The least complicated cases are observed when a ball enters the lumbar region and penetrates the cortical substance; whereas if the peritoneum is also wounded urine escapes into the cavity of the belly, and fatal peritonitis is almost inevitable.

The experience of that war seems to justify the view that for the escape of urine from the kidney into the parts around, the pyramidal structure at least, if not also the calyces or the renal pelvis, must be wounded. Urinary infiltration into the retro-peritoneal tissue does not seem to be a common consequence of shot wounds of the kidney.

During the war, a total of seventy-eight cases of gun-shot wounds of the kidney were recorded. Of these, fifteen cases of wound of the right organ were associated with wound of the liver; six of the left kidney with wound of the spleen; seven cases of wound of one or other kidney were complicated by wounds of the intestine, and five by wounds of the spinal column. Fractures of the lower ribs were frequently associated with renal injuries. In six out of nineteen other cases, the renal wounds caused death in the first few days from shock or hæmorrhage; and two men lingered for seven and nine months respectively, and died of exhausion from suppuration. Of twenty-six cases of recovery, thirteen were wounds of the right and twelve of the left kidney; in one case the side is not stated. Fifteen were pensioners, and appeared to have been alive ten years at least after receiving their wounds. In six of the successful cases the liver also was wounded. All the six cases in which the spleen was wounded were fatal.

But it is stated that though the instances of recovery from shot wounds of the kidney reported during the war were not unfrequent, they are generally wanting in such details as would establish them as unequivocal.

A case * is given of quite miraculous recovery after a gunshot wound. The injury was followed by considerable hæmorrhage, six days of neglect of treatment, repeated journeys of many miles, a convalescence complicated by typhoid fever, and a

* "War of the American Rebellion," part ii., vol. ii., p. 164. Quoted from the *Confederate States' Medical and Surgical Journal.*

renal abscess, which discharged externally and resulted in a urinary fistula, but which subsequently closed. This case teaches the important lesson that a surgeon should never abandon as hopeless any case of injury, however unpromising it may at first sight appear.

Twenty-one additional instances of recovery from gun-shot wounds are collected from various sources and referred to by the editor, Dr. Otis. In some of these cases parts of the organ have been torn off and carried away by the missile, so that one or other end has been wanting ; in other cases the bullet has transfixed the organ, leaving a lacerated hole right through it.

Secondary hæmorrhage may occur when the sloughs separate, and cause sudden death.

The healing of a gun-shot wound of the kidney takes place, after separation of the eschar and a period of more or less suppuration, by the development of granulations which fill the track of the bullet, and subsequently organise into cicatricial tissue. Thus, in an instance recorded by Legouest, a kidney, which had been penetrated by a ball from before backwards near its centre, had upon each face a depressed solid fibrous cicatrix, with fibrous rays branching from it. The man (a Russian soldier), at the battle of Inkermann, had sustained two gun-shot wounds, one in the loin and one in the left knee. He died from the consequences of the wound of the knee-joint, and thus the repair of the extensive injuries to the kidney was proved in this case.

Professor Socin reports the case of a man who received a shot wound in August, 1870. The patient was alive in March, 1871, but died shortly afterwards, from a cause not stated. After death the shot was found encysted in the kidney.

Several cases in which death has not taken place until a long time after the infliction of the wound have shown clear evidence of perfect cicatrisation.

Jules Luys records a case of unquestionable gun-shot wound of the kidney in a man who died nine years afterwards ; a mass of fibrous tissue was found filling the wound in the substance of the kidney.

Klebs, however, states that in two cases of gun-shot wound, fatal on the fourteenth and eighteenth days respectively, no interstitial new formations were found in either kidney.

Urinary fistula of long duration is not a common result, even after gun-shot wounds, for it is only reported in one out of the twenty-six recoveries during the American Civil War. There were but few instances of urinary abscesses, and no examples of persistent urinary fistula. The duration of life in the fatal cases has varied from a day or two to eight or nine months or more; the early deaths having been due to shock or hæmorrhage, the later ones to protracted suppuration.

Sometimes the bladder is highly inflamed by extension of the inflammation along the ureter from the renal pelvis; in Von Brun's case the opposite kidney was the seat of numerous miliary abscesses, and the probability is that the septic infection spread from the bladder by ascending ureteritis on the opposite side.

When wasting or paralysis of the muscles of the spine or lower limb has followed wounds of the kidney (and these sequelæ have been noted in several instances of gun-shot wound) there has been division or laceration of the nerves supplying those muscles.

Dr. W. S. Bird* describes a case of gun-shot wound of the kidney in a man, aged forty. The bullet entered, leaving a small wound on the right side, below the margin of the false ribs. In the back was a similar wound occupying the same relative position. He was shot by a man some ten or twenty feet in front of him. He walked to a physician's office and then home. He did not vomit, but during the first four hours he several times discharged liquid blood by the bowel. Laparotomy next day revealed no wound of the peritoneum, but an extravasation behind the peritoneum around the right kidney. Nothing more was done and the wound was closed. He died suddenly twelve hours after the operation. A post-mortem examination disclosed a penetrating wound of the middle of the anterior surface of the right kidney, the bullet had destroyed that part of the organ and laid it open to its outer or right border. The renal pelvis was not opened.

The case is remarkable because of the anterior surface being penetrated from the front without injury to the peritoneum; and secondly, because only clear urine was drawn off during life, or was present in the bladder after death. No doubt the vessels of the parenchyma were at once plugged or thrombosed, and

* *Med. Rec.*, April 10th, 1897.

as the renal pelvis was not opened, no blood escaped into it or into the ureter or bladder.

Bernays records a case in which a negro, forty-two years of age, was shot in the lumbar region, the ball entering $1\frac{1}{2}$ inches from the spine below the twelfth rib, passing straight through the loin and lodging near the gall-bladder 2 inches from the middle line and the same distance below the costal margin, whence it was extracted. There was profound shock, and one hour after the injury there was intense and continuous hæmaturia; on this account the loin was explored: a large hæmatoma was found, and on reaching the kidney the ball was seen to have passed completely through the organ opening the pelvis, ureter, and renal vein. The kidney was therefore removed. The bullet was extracted from the front and the wound packed with gauze. The nephrectomy incision healed by first intention and the packing was removed from the front in eight days, the patient being discharged cured in sixty days.

Operative interference is more satisfactory at the time of the injury than after the supervention of suppuration or uræmia, when the kidney is destroyed and the operation practically amounts to the mere opening of a lumbar abscess. An early nephrotomy enables the surgeon to ascertain the extent of injury and either to simply drain the region or perform partial or total nephrectomy. Since Gustav Simon first removed the kidney at Heidelberg in 1868, the operation has been repeated several hundreds of times, but only on five occasions on account of bullet wound.

Keen of Philadelphia in 1896 collected nineteen cases of gun-shot wound. Of these, ten recovered and nine died, four dying after nephrectomy and five without the operation having been performed. In only five of the nineteen cases was nephrectomy done. In the successful operation there was also injury to the liver followed by multiple abscesses. Of the fatal operations the result was due in one case (Keen's) to gangrene of the intestine fifteen days after the operation; in another (Willard's), to severe hæmorrhage, the renal artery and vein having been divided by the ball, which finally lodged in the wall of the aorta; while in the other two (Von Brun's and Richardson's) death resulted from subsequent suppuration or nephritis in the

other kidney.   In the five fatal cases not nephrectomised, three died of peritonitis and two of hæmorrhage.

Of the ten which recovered, five teach especially important lessons. In Mayo's case there were two perforations of the intestine, a wound of the omentum and perforation of the pleura, the kidney being perforated and blood present in the abdominal cavity. Laparotomy and lumbar drainage saved both the kidney and the patient. In Dalton's two cases, though the abdomen in one and the abdomen and pleura in the other had been traversed by the ball, yet, there being no evidence of serious internal hæmorrhage and none of wound of the intestine (the liver dulness not having disappeared), abdominal section was not done and conservative surgery was justified by the happy result in each. In Richardson's case the liver and kidney were both perforated, the latter seriously, and there was free intra-peritoneal hæmorrhage, yet abdominal section, removal of the clots, and drainage of the renal wound were followed by cure. In Tiffany's case both the spleen and kidney were perforated, yet ligation of the spleen tissue, and gauze tamponnade and drainage of the kidney, were followed by a good result.

Dr. E. Adenot[*] records a case of a boy of seventeen being shot in the left side : the ball of a revolver penetrated the antero-lateral wall of the belly and wounded the kidney after passing through the parietal peritoneum. Laparotomy was at once performed, a quantity of blood-clot removed, and the starred and fissured wound of the kidney detected ; the ball was not extracted. Subsequently the projectile was located by the radiograph and removed through the lumbar incision. Secondary infection took place and the lumbar wound had to be reopened for more effective circumrenal drainage. The patient ultimately recovered, after a somewhat tedious illness, with the preservation of the wounded organ.

Symptoms. — The immediate effect of gun-shot wound of the kidney, as of any other abdominal organ, is collapse, attended by the usual manifestations of that condition : blanching of the surface, cold sweats, small rapid pulse, cold extremities and complete muscular prostration. Not unfrequently, when

[*] *Lyon Méd.*, Juin 5, 1898 ; *Annales des Mal. des Organes Génito-urinaires*, Avril, 1899, p. 395.

reaction sets in vomiting occurs, there is severe pain in the injured region often extending to the entire side, and especially involving the testicle which may be retracted.

The pain appears to be more severe in those cases in which the kidney is crushed or torn, and is comparatively slight when the organ is simply perforated. Severe pain of a colicky character referred to the testicle, scrotum, or groin may indicate the presence of blood-clot in the ureter.

Escape of urine occurs from the wound, and is a certain sign not only of renal injury but that the pelvis of the organ has been penetrated. The rapidity with which it occurs depends on the shortness of the channel to the kidney and the supervention of reaction after collapse, and also upon the length of time taken in the separation of the eschar or sloughs.

Hæmorrhage from the wound is usually slight, owing to the formation of an eschar along the track of the projectile; it may, however, be considerable, especially where large vessels are lacerated ; it may take place either immediately, or with the separation of the eschar in from five to twelve days. It is a nearly constant sign in the early stage, and also after separation of the eschar. As inflammation develops, a sanguineous discharge is commonly followed by the escape of pus both by the wound and along the ureter. This occurs earlier and with greater intensity when foreign bodies accompany the bullet, particularly when such foreign substance is of a septic nature like portions of clothing.

The presence of a foreign body is indicated in addition by rigors and intermittent fever, an unhealthy appearance of the wound and breaking down of granulation tissue, with septic peritonitis or metastatic pyæmic abscesses if the condition is not relieved.

Besides these direct manifestations of the renal injury, there may be indications of the effusion of gas, blood, or urine, and later of pus around the kidney, or in the peritoneum in the case of an abdominal wound, or into the pleura if the thorax is penetrated, which may cause the kidney injury to be overlooked till urgent straining and the passing of bloody urine draw attention to it.

On the other hand, though the evidence of wound of the kidney be indisputable, and the bullet pass completely through the trunk, penetrating the peritoneal cavity, there may be no

serious injury of important organs, and the patient may recover completely without operative interference. Thus in a case reported by Surgeon-Major A. Hayes in the *British Medical Journal* (i., 1886, p. 150), a man received a perforating gun-shot wound of the abdomen by a Martini ball, implicating the right kidney and producing profuse secondary hæmaturia. The ball entered just to the right of the umbilicus and made its exit over the posterior region of the right kidney, the probe showing that the bullet had gone straight across and not round the abdominal wall. The urine was smoky directly after the accident, and on the seventh day large quantities of blood were passed *per urethram*, which continued for five days and had a bright arterial colour. The patient recovered completely without operative interference.

Grawitz* quotes six similar cases, five of which recovered without operation, the sixth dying some time after the injured left organ had been removed, from suppurative nephritis, or, as Grawitz writes, "nephritis apostematosa," of the remaining kidney.

It would appear from these cases that the principal danger in uncomplicated renal injury is septic infection, while that from hæmorrhage is by comparison slight. The most careful aseptic measures should therefore be observed in the treatment of such cases, and the use of the catheter as far as possible should be avoided.

An analysis of thirty-seven of the fifty cases referred to by Edler, of which twenty-two proved fatal, showed that hæmaturia was the most constant symptom, being noted in twenty-six instances ; pyuria occurred in nine ; ten were marked by escape of urine from the wound ; seven by paraplegia, and an equal number by neuralgia and other nervous manifestations ; four showed symptoms of nephritis, and three disturbance of the function of the opposite kidney.

Analysis of the symptoms of gun-shot wounds of kidney during the American Civil War.—Of twenty-six cases of reported recovery from wounds of the kidney, during the American Civil War, hæmaturia occurred in fifteen. Various forms of dysuria are referred to, and lumbar pains, muscular rigidity, partial paralysis, and other disabilities are mentioned. Abstracts of fourteen of these cases are published in the "History," and as many of them lived for several years they supply some important information

* *Arch. f. klin. Chir.*, 1889 bd. xxxviii., pp. 438-9.

as to symptoms and ultimate results.   From such facts concerning
these fourteen cases as are supplied I find that seven had hæma-
turia, two pus in the urine, three pain on micturition, two re-
tention of urine, one for ten days, the other only until the day
after the injury.   One had retraction of, and one acute pain in,
the testis.   Four had paralysis of the muscles of the leg of the
same side as the injured kidney, and three had some weakness
of the muscles of the spine and were unable to stoop or lift
any weight, or were bent and could not straighten the back
without pain in the region of the kidney.   In one case, in which
the wound of the kidney was complicated with wound of the
intestine, the patient passed a musket ball, weighing an ounce,
with the stool ten days after he was shot; this man was alive
ten years afterwards, but was totally disabled by incomplete
paralysis of the right side and constant pain in the back and
neck, sometimes so severe as to confine him to bed for several
days.   In another case in which the descending colon, as well
as the left kidney, was injured, there was a permanent fæcal
fistula; this man was alive nine years after the infliction of
the wound.

The editor of the " History " remarks that in a few cases
pus and phosphatic deposits in the urine were observed for con-
siderable periods.

After hæmaturia has ceased, blood in microscopic quantity, as
well as pus and tube casts, may be found in the urine.

In a very remarkable case (No. 513)* the ball entered over the
outer part of the left clavicle whilst the soldier was stooping,
and having passed through the lung it lodged in the region of
the left kidney, and was extracted on the tenth day, together
with fragments of fractured bone.   Hæmaturia continued for
eight or ten days after the injury.   Nearly five months afterwards
the urine contained albumen, granular uriniferous tube casts,
and blood and pus corpuscles.   This man was alive ten years
and a month after receiving the wound, but had frequent pain
in the shoulder, and his left arm was partially paralysed.

Secondary hæmorrhage is common after the separation of
eschars or sloughs.   When hæmaturia comes on six, seven, eight
days, or later, after a gun-shot wound, it is generally caused

* " History of the War of the American Rebellion."

by the separation of sloughs. Herein rests a great distinction between gun-shot wounds and incised wounds. The latter may heal rapidly and without suppuration ; the gun-shot wounds are followed by more or less sloughing and suppuration and all the risks to which those processes expose the patient.

There may be second hæmorrhage from the bowel without hæmaturia if the colon as well as the kidney is damaged ; or a retro-peritoneal abscess may be a secondary consequence, as in the following fatal case, recorded by Lidell.*

A man, aged twenty-nine, was shot in the right hypochondriac region just below the margin of the ribs. Pain, tympanitis and hæmaturia were quickly exhibited. On the following day the hæmaturia continued, but after this it appears to have ceased. On the fifth day the abdominal pain and tympanitis had increased, and blood had been seen in the stools. The patient died on the thirteenth day from the bursting of a retro-peritoneal abscess into the right pleura. The right kidney had been pierced at its lower end ; the bullet was found against the sacrum.

Lidell † gives an instance of gun-shot wound of the right kidney, in which the patient died of *peritonitis* fifteen days after he was wounded. The right kidney had been pierced by the ball, which was found lying loose in the cellular tissue near the spinal column ; the kidney was for the most part disintegrated, the bladder highly inflamed and filled with bloody pus, and the peritoneum everywhere inflamed. The ball entered about two inches to the left of the third lumbar vertebra, and passing obliquely forwards, upwards, and to the right, traversed the bodies of the second and third lumbar vertebræ to reach the right kidney.

When the injury to the kidney is associated with wounds of the stomach, liver, spleen, or other important structures, such as the intestines, diaphragm, or thorax, an almost certain and generally a very speedy death from shock, or shock and hæmorrhage combined, must be anticipated. When the spinal column is involved symptoms due to that lesion will be present. Thus, in Lidell's case just quoted there was partial paralysis of the lower extremities with diarrhœa and inability to void urine from

* *Amer. Journ. Med. Sciences*, April, 1867, p. 356 : "Injuries of the Abdominal Viscera by Firearms."

† *Amer. Journ. Med. Sciences*, Oct., 1864, p. 134 : " Injuries of the Spine."

the first ; on the ninth day peritonitis and ischuria renalis, and on the thirteenth complete paralysis of the lower limbs and enuresis in place of retention of urine, occurred.

If foreign substances have been carried into the wound and become lodged in the interior of the kidney, much pain and even very violent suffering may be caused by the transit of the foreign body along the ureter and urethra.

Portions of clothing carried in by a bullet may possibly be detected and removed through the external wound.

Sometimes as the result of ulceration air may gain admission to the renal pelvis. Sometimes a fragment of bone may either be driven into the kidney by the weapon, or find its way there after a time by pressure or ulceration.

In two remarkable gun-shot cases, pieces of cloth from the soldiers' uniforms (in one instance accompanied by " epithelial detritus," and in the other coated with phosphates) were passed by the urethra. One of these is mentioned by Demme,* who says, " One of my colleagues at the Ospedale, San Francisco, observed a case of shot wound of the kidney in which a piece of cloth from the soldier's uniform passed by the urethra ; examination proved the cloth to be impregnated with epithelial detritus."

The other, probably the most singular case on record, as illustrating nearly the whole series of symptoms of injuries of the kidney, is recorded by Hennen.†

An officer was wounded by a musket-ball, which entered between the ninth and tenth ribs, and about midway between the sternum and the spine, and was cut out from near the point of the transverse process of the lowermost dorsal vertebra, on the day after the receipt of the wound. Within an hour he voided a quantity of bloody urine. He was in extreme pain, which was aggravated by his being moved a distance of three leagues the same night. Soon the pain spread from his wound over his bowels, and delirium supervened ; he was then bled several times, and blisters were applied to his abdomen. Then followed intense pain in his right shoulder, and the wound in his back nearly mortified from his lying so long, but in seven weeks he was well enough to be sent to England. The journey excited fever,

---

* *Med.-Chir. Studien*, bd. ii., s. 151 (1861).
† *Op. cit.*, pp. 442 *et seq.*

and a recurrence of peritonitis ; and a tumour formed in the site of the posterior wound, which was punctured at the end of a fortnight, and six ounces of pus having a urinous smell were evacuated. The discharge continued for some time, and another abscess formed lower down, which was punctured in about three weeks, and a large quantity of pus of the same kind escaped. The abscess healed and burst again and again. Pain, emaciation, and frequent micturition followed, but with actual diminution of the quantity of urine voided, together with the symptoms of renal colic. And then, at the expiration of seven months from the infliction of the wound, he passed *per urethram* something having the shape of a short thick shrimp, which upon examination proved to be a piece of cloth, covered with black grit. After this he rapidly convalesced.

Stromeyer relates the case of a Danish officer who was shot in the right side under the short ribs, and who soon after passed urine through the wound, and had hæmaturia. A concrement of the size of an orange pip was voided *per urethram* two months after.

Diagnosis.—The diagnosis of gun-shot wounds must be made with reference to the situation and direction of the track of the wound, the presence of blood in the urine, and the escape of urine by the external wound. The situation of the pain, the suppression or partial suppression of urine combined with hæmaturia or the discharge of a little urine from the wound are also most important indications. Allowing for the difference in the character of the wound inflicted by firearms and by penetrating weapons other than firearms, and for the fact that whilst firearms contuse the tissues, which therefore are less prone to primary hæmorrhage than wounds inflicted by cutting instruments, the points of diagnosis of the one class are the same as those of the other. The reader therefore is referred to the description given of the diagnosis of Incised and Punctured Wounds on previous pages.

Prognosis.—In the fifty instances of gun-shot wounds of the kidney cited by Edler the fatalities were twenty-two, of which eight were due to complications, six to pyæmia after three months, and eight to peritonitis or hæmorrhage within eight days.

Of extra-peritoneal shot wounds, about one-fourth appear to end fatally. The difference in prognosis between complicated and uncomplicated shot wounds of the kidney in the above series is clearly indicated in the following table:—

			Recovered.	Died.	Total.	Per cent.
Uncomplicated	..	..	15	5	20	85
Complicated	..	..	3	15	18	80
Not stated	..	..	10	2	12	16·8

In a larger series, quoted by Küster in 1896, we find the following results:—

		Recovered.	Died.	Total.	Per cent.
American War	..	26	59	85	69·41
Franco-German War	..	7	8	15	53·33
Other cases, chiefly in civil life	37	13	50	26

The difference in mortality in military practice is attributed to the circumstances of war and the greater size and velocity of the projectile. The prognosis is also very much worse when the spinal cord or the thoracic or abdominal cavities are injured, or when foreign bodies are carried into the wound.

In the series of nineteen cases collected by Keen between the years 1884 and 1896 ten recovered, and nine died, and an analysis of the injuries shows the same preponderance of mortality in the complicated over the uncomplicated cases.

Complications, such as wounds of the spinal column, diaphragm and intestines, bring their own results, so that actual recovery from a wound of the kidney may be followed by death due to such complications. In some of these fatal cases the kidney was repaired and had been performing a large share of the work of excretion.

Treatment.—The first measures must be directed to the relief of the state of shock, which occurs immediately on receipt of the wound.

Complete rest, warmth and stimulants are needed in this stage, and should be followed shortly by the administration of morphia to relieve pain and restlessness. Any interference with the wound is prohibited, and it is best merely to cleanse and cover it with a loose absorbent dressing such as a pad made of double cyanide gauze tissue or some other absorbent and antiseptic material. Plugging is undesirable as it leads to internal accumulation of blood and urine or to inflammatory exudation. When reaction occurs, a wound in the thorax or abdomen may be closed, provided the bullet

has passed out and there is no indication of hæmorrhage or injury to organs that requires immediate interference. Such a favourable state of things is necessarily very rare and must not be hastily assumed to exist.

If the bullet remains in the body it should be carefully sought for and, if possible, removed, with any foreign bodies such as portions of clothing or splinters of bone that may have been carried in with it.

We learn from the History of the American Civil War that "urinous infiltration in the lumbar cellular tissue does not appear to be common after shot wounds of the kidney. The reason probably is, that the eschars lining the track protect the parts until a limiting wall of inflammatory exudation has formed. Hence it seems unwise to enlarge the exit wounds at first; but later on, the free incision of the phlegmonous accumulations likely to form in the loin constitutes a most important part of the treatment."

During this War of the American Rebellion we are told that the practice which Larrey and Dupuytren enjoined, of freely enlarging the lumbar orifices of wounds of the kidney to prevent the infiltration of urine internally, or amongst the muscles of the back, does not appear to have been at all followed. Thus we read: "Nephrotomy was not practised. Though there were several instances of lodgment of balls in the kidney, and cases of laceration, without communication with the peritoneal sac, there appear to have been none in which the attendant circumstances were thought to require nephrotomy, or to warrant the operation of extirpation of the kidney." It must, however, be observed that this statement was published in 1876, and refers to a period of from eleven to thirteen years before, and that the first nephrectomy was not performed till 1869; and one cannot but feel that with our present experience of renal operations, several of the recorded cases of gun-shot injuries might with advantage have been submitted to one or other of them.

It is probable, however, that when the Surgical History of the South African War comes to be written the same absence of operative treatment for wounds of the kidney will have to be recorded, but that the reasons assigned for not operating will be different.

Already we have heard enough to know that penetrating wounds of the kidney caused by small-bore bullets do not necessarily set up fatal mischief, even when other organs—the liver, the spleen, or the intestines—are also penetrated : that even if large blood-vessels within a solid organ are partially divided hæmorrhage need not be serious ; and that the kidney or the liver may be traversed from before backwards or from side to side without any symptoms of importance following. A shrapnel bullet has been known to pass through both liver and kidney and yet cause only slight collapse and some temporary tympanites and hæmaturia. Mauser bullets have traversed the abdomen in all kinds of directions, and yet the wounded men have made good recoveries without requiring operation.

It is the contused and lacerated wound, and the wound made septic by the introduction of other foreign bodies, such . as pieces of clothing and fragments of bone, as well as the bullet, which give rise to grave consequences at the time and serious complications at a later date. Small-bore bullets make exceedingly small wounds and do not lacerate ; hence in many instances there are practically no immediate symptoms and no after ill-effects whatever.

The question of surgical interference will be settled by the nature and extent of the injury. So far as the kidney itself is concerned, a superficial wound of the cortex leads to no extravasation of urine, to but trifling hæmorrhage, and to practically no risk of auto-infection, owing to the fact that only capillary vessels and tubes are laid open and rapidly close, allowing of no communication with the bladder, and supplying but little clot or exudation in which wandering germs can develop. In such cases careful aseptic dressing of the wound may be all that is necessary.

When the bullet lays open the ureter, renal pelvis, or vessels of the hilum, there ensues extravasation of blood or urine or both together. The immediate danger from hæmorrhage, either into the abdominal cavity if the peritoneum is rent, into the bladder by way of the renal pelvis and ureter, or, if these are closed, into the parts surrounding the kidney, is very great ; and the risk of subsequent infection of large blood or urinous effusions, especially where there is free communication with the bladder

through the ureter, makes the prospect of saving the kidney or the life of the patient almost hopeless.   Taking these matters into consideration, and also the fact that an injury at the hilum of the kidney, producing these conditions, necessarily involves loss of function, if not actual death of the organ, nothing remains but to explore the kidney and, if necessary, to remove it.

In cases where the main vessels are divided, hæmorrhage is generally so severe and continuous that immediate operation is the only means of arresting it in time to save life.   An instance of this is recorded by Willard.*   Both artery and vein were divided and the ball lodged in the wall of the aorta : abdominal nephrectomy was performed immediately and the patient survived four days, but ultimately died of hæmorrhage.

Besides these extremes, as regards severity of the injury, there are perhaps a greater number of intermediate cases which must be treated each on its merits; they call in most instances for exploration, but on examination the kidney need not in every one be sacrificed.

Except in those cases where the bullet has entered from the back or side, and the damage is presumably retro-peritoneal, it is for the most part best to make an abdominal incision so as to be able to deal with hæmorrhage into the peritoneum and injuries to other abdominal viscera, besides having a wider view of the ureter and vessels.

The opening is usually made in the middle line, but Langenbuch's incision along the side of the rectus may be preferable when the injury is believed to be limited to one side.

The first necessity is to stop bleeding and clear out blood and clot from the peritoneal cavity.   Nephrectomy is required when the vessels or renal pelvis are so damaged as to interfere with the vitality or excretory function of the organ, but should one pole only be injured a partial excision may suffice.   Keen† was the first to publish a case of nephrectomy for gun-shot wound of the kidney.   The stomach, liver and ileum, were involved, as well as the mesenteric artery.   The patient died on the fifteenth day from peritonitis due to gangrene of the bowel.   The nephrectomy was by the abdominal method.

* *Trans. Amer. Surg. Assoc.*, 1888, vol. vi., p. 516.
† *Trans. Amer. Surg. Assoc.*, 1887, vol. v., p. 193.

The removal of clots from the bladder is of the utmost importance, not only on account of the pain and discomfort they produce and the obstruction they cause to urination, but because of their tendency to septic infection and suppuration, with the consequent changes in the kidneys and in the environment of the wound.

In Willard's case, the bladder being found full of clots when it was examined at the time of the abdominal nephrectomy, and its walls being intact, he simply removed all the clotted blood in the bladder by squeezing it with his hands.

If no abdominal opening has been made, the clots may be broken up and removed by means of a large catheter or Bigelow's evacuator; and should the bleeding be continuous and severe the kidney must be removed, or a free incision made into the bladder to ensure its remaining free of subsequently formed clot.

The importance of removing clots of blood from the bladder has been mentioned in describing the treatment of ruptured kidney, and it cannot be too fully emphasised. The aseptic catheterisation and irrigation should be first tried, but if these means fail, the bladder should be cleared by cystotomy.

It matters but little whether the bladder be reached by a perineal or suprapubic incision, so long as there is a free exit for the escape of the clots, but on the whole, the suprapubic opening is to be preferred as being more easily kept aseptic. Foreign bodies introduced into the kidney and escaping along the ureter into the bladder require removal. It is impossible to read the account of Hennen's celebrated case, or to have witnessed the sufferings of Hilton's patient, to whom I have before referred (p. 184), without feeling convinced that both would have been saved a world of pain had cystotomy been performed. In Hennen's case, moreover, the operation would doubtless have led to the early detection and removal of the foreign body in the bladder, to the expulsion of which, along the urethra, the agony of the latter period of the case was due.

That Hennen's patient at length recovered by nature's efforts without an operation is no argument whatever against nephrotomy and cystotomy in similar cases. Miraculous recoveries must not make us lose sight of general principles, nor extraordinary cures cause us to forget ordinary dangers.

Hæmorrhage should be checked by the internal administration of large and quickly repeated doses of ergot, by the local application of ice, and by well-directed pressure upon the loin ; care must meanwhile be taken to secure good drainage of the wound.

If life be threatened by hæmorrhage or suppuration, the kidney ought to be removed by lumbar nephrectomy.

Simon gave it as his opinion " that it might be advantageous in uncomplicated cases of injury to the kidney, where the kidney suppurated (cases almost invariably fatal), to extirpate the injured kidney." Billroth (in 1870—1872), quoting this remark of Simon's, added, " I would not hesitate to perform this operation, should an opportunity offer." At the present day nephrectomy, or nephrotomy with drainage, according to the circumstances of the case, is acknowledged to be the right treatment for this condition.

The persistence of a urinary fistula in a case which has otherwise ended favourably calls for a plastic operation to close the false channel.

If phlegmonous inflammation or extravasation occurs, free incisions should not be delayed, and if a circumscribed collection of urine or blood is formed, though repeated aspirations might possibly bring about a cure, yet they ought not to be relied upon—a free incision and drainage being not only more certain but also much quicker in its effect.

Professor von Brun published a case, in 1871, of a man with urinary fistula, following a shot wound received in December, 1870 ; a portion of the left kidney was extirpated March 23rd, 1871, and death resulted ten hours afterwards. The organ was so adherent that its complete removal was impracticable. It was converted into a large abscess. The right kidney was also dotted with small abscesses, an indication, probably, that the nephrectomy was too long delayed.

CHAPTER VIII.

ANEURYSM OF THE RENAL ARTERY.

REFERENCE has already been made (p. 161) to traumatic aneurysm as one of the consequences of subparietal injury, but aneurysms of the renal artery and its branches occur also from other causes than injury. Whether traumatic or spontaneous, they are among the rarest of all aneurysms.

Two varieties are found after injuries: (1) small sacciform aneurysms, the walls of which are formed by some or all the coats of the artery; and (2) large false aneurysms, the walls of which become more or less firmly matted to the surrounding organs and tissues.

A false aneurysm may go on growing for years, and ultimately attain an enormous size. It can develop in three ways, namely: (a) by the giving way of a small true aneurysm; (b) by the yielding of a thrombus which temporarily closes a ruptured artery; and (c) by the immediate outpouring of blood from a ruptured artery.

A true or sacciform aneurysm—always, apparently, of small size—if of traumatic origin, may be associated with an extravasation of blood or urine, or of blood and urine; both being the consequences of the same accident. One such case, at least, is on record (Reeves's or Turner's). In this case the swelling detected during life was a false hydro-hæmato-nephrosis. The small aneurysm was a post-mortem discovery, and had no bearing on the cause of death; but none the less it was a very interesting and rare result of injury.

A true aneurysm may be associated with a false aneurysm, and both may be the direct result of the same accident: thus a small sacciform aneurysm may be situated on the renal artery, and the artery or one of its branches may be torn across or lacerated further on, and there open into the false aneurysmal sac. Such was the condition in Hilton's case.

In an article published in the *Lancet* of October 6th, 1900, I have given brief abstracts of nineteen cases of renal aneurysm, and these are all which up to the present are known to have

occurred. The cases fall into different groups as follow: (1) True
aneurysm of traumatic origin associated with false hydro-hæmato-
nephrosis, one case; (2) true aneurysm of traumatic origin
associated with false aneurysm due to rupture of the artery and
not of the sacciform aneurysm, one case; (3) false aneurysm due
to the bursting of a sacciform aneurysm, three cases; (4) false
aneurysm due to yielding of a thrombus in a ruptured artery,
one case; (5) false aneurysm following immediately on the wound
of the artery, six cases; (6) aneurysm of the renal artery not
of traumatic origin, seven cases.

Although the cases there collected are the only instances of
aneurysm of the renal artery or its branches with which I
am acquainted, it is probable that many others of the kind
have been overlooked at post-mortem examinations, or, if de-
tected, have remained unrecorded. Now that attention has
been drawn to their occurrence, there will, I anticipate, be
other examples forthcoming in the near future. As a result
of injury, aneurysm, whether of the sacciform or diffused type,
is of great practical importance. If of the sacciform type, it
would seem to be usually either associated with some other
injury to the kidney or renal pelvis giving rise to hæmaturia or
a large tumour consisting of blood and urine; or the sacciform
aneurysm after a time ruptures and a false aneurysm is formed.

A false aneurysm, whether caused by the rupture of a sacci-
form aneurysm or by the direct rupture of the walls of the
artery, gives rise to a tumour of great clinical interest—puzzling
to diagnose, difficult and dangerous to treat, and hitherto, if not
operated upon, invariably fatal.

The knowledge that an aneurysmal tumour is occasionally a
late and not an immediate consequence of injury; that it may
be caused by an accident which either slightly or extensively
damages the kidney; that it often ultimately leads to absolute
destruction by atrophy or inflammation of the whole or a con-
siderable part of the organ; and, finally, that there is great risk
attached to operative treatment, and certain death if such treat-
ment is not adopted—such knowledge ought to be an additional
inducement to surgeons, if other conditions do not contra-indicate
the operation, to explore early every kidney which is seriously
damaged by an accident.

Etiology.—Of the nineteen cases of renal aneurysm which I have collected (the number of cases I collected is twenty-one, but two are omitted from the analysis for reasons given in the article referred to), twelve were traumatic and seven spontaneous. Of the traumatic cases two were sacciform when discovered after death, nine were false, and one doubtful. Of the nine false aneurysms two occurred from the bursting of a sacciform aneurysm; one followed after a time from the yielding of a thrombus in the ruptured artery, without having been preceded by a sacciform aneurysm; five were the immediate consequence of rupture of the artery; and in one the nature of the aneurysm is not mentioned.

Of the seven spontaneous aneurysms, three were sacciform. One of these was described as being of the size of an apple, and two of the size of a haricot bean and of a hazel nut respectively. One was a false aneurysm in the form of a true hæmato-nephrosis.

In one case no description of the aneurysm is given beyond the fact that it ruptured into the renal pelvis. The sixth was probably sacciform originally, but ruptured and became a false aneurysm, forming an intra-capsular tumour surrounding the kidney. The seventh seems to have been a false aneurysm from the beginning.

Sex.—Of the twelve traumatic cases, ten were in men, two were in women. In the case of one of the women there might be some doubt as to whether the sacciform aneurysm which subsequently ruptured was really of traumatic origin, because though she had a fall on a staircase, she had apoplexy from a hæmorrhage into the left optic thalamus, and was the subject of endarteritis—her aorta and other arteries being affected. The branches of the renal artery next the clot were markedly dilated and tortuous.

Of the seven spontaneous aneurysms, four were in males, three in females.

Age. — Of the traumatic cases the age is stated in ten. One was fifteen, one nineteen, one twenty-one, one twenty-five years, one thirty-six, another thirty-nine, and four were between the ages of forty-nine and fifty-one. Of those whose ages are not given, both were men in active life; one is described as a "young boatman," the other as a "doctor," whose aneurysm resulted from a fall from a horse four years before his death.

Of the spontaneous cases the ages of six are stated : they were all over forty ; the youngest was forty-three, the eldest sixty-six. The seventh was described as " a young man."

Nature of injury or disease.—Of the traumatic cases, one patient was thrown out of a cart ; another was struck by the buffer of an engine ; a third was thrown from a horse ; two fell from a height, striking the loin on the side of the injured kidney ; one slipped and struck his loin on the gunwale of his boat ; one fell against a counter and contused his side ; one fell against a box ; another slipped and fell against the edge of a low wall ; two fell against steps or a staircase ; and one was run over by a handcart.

Of the spontaneous cases, malignant endocarditis with multiple emboli was present in one case ; calcareous degeneration of the coats of the arteries was found in two others ; another died of nephritis ; the fifth died comatose with destruction of one kidney from the aneurysm and chronic nephritis of the opposite kidney. In the sixth the patient had what must have been erroneously called an attack of " rheumatic fever," for it passed off in five days. It seems probable that an embolus or a thrombus led to the development of the aneurysm. In the seventh case there was absolutely no assignable cause. Leudet, following Corvisart, Guthrie, and Bérard, thought these small aneurysms were developed in the substance of the wall of the vessel and subsequently opened into the lumen of the artery.

Pathological consequences.—As long as a sacciform aneurysm remains unruptured it seems not to produce any distinct changes in the kidney or parts around. If situated within the kidney capsule the little tumour may press aside and more or less flatten some of the tubules, as in Armstrong's case, but without destroying them. If a sacciform aneurysm bursts into the renal pelvis profuse hæmorrhage is the result ; the bladder may become distended with blood and blood-clot, and blood may flow away from the urethra as in Gossett's and Oestreich's cases. The patient thus dies from sheer loss of blood, or from this cause combined with the pain and other effects of blood-clots distending and decomposing within the bladder.

When a false aneurysm is formed—whether as the effect of injury or disease, and whether indirectly by the rupture of a

sacciform aneurysm, or directly by the giving way of the artery matters not—serious damage is generally done to the kidney, and extensive pressure changes and displacements are wrought in the surrounding tissues and organs.   The blood may distend the pelvis and calyces, and, producing complete absorption of the renal parenchyma, create a true hæmato-nephrosis ; or it may be extravasated entirely within the capsule, between it and the renal parenchyma ; or it may be extravasated partly within the renal capsule and partly into the perinephric tissue ; or it may be entirely outside the renal capsule completely or partially surrounding it.   The kidney may have undergone complete or partial atrophy ;
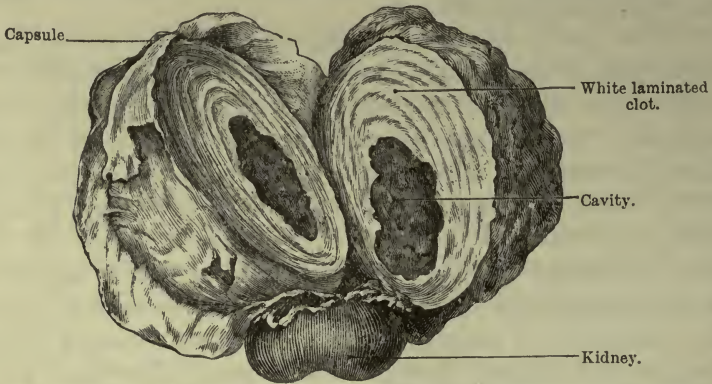

Fig. 31.—Aneurysm of Renal Artery with Kidney.   Removed during life by Albert of Vienna.   (Reproduced from Hochenegg's paper.)

or the kidney, if any remains of it, may be spread out in the wall of the sac, as it was in the case under my own care, in which the kidney had almost, and its adrenal had completely, disappeared.

When part of the kidney has been flattened out or absorbed the rest of the organ may appear to be covered by the same capsule.   Even when the aneurysm has been stated to be entirely separate from the kidney it is yet described as being in the same capsule (Hahn).   This condition of the capsule is, I have no doubt, in some cases only apparent, not real.   The matting together of the sac of the aneurysm and the structures adjacent becomes so intimate and firm that it is impossible to say where renal capsule ends and sac begins.   It is the same with the capsule of an adrenal tumour, as is pointed out in Chapter XXIII., when describing " Tumours of the Adrenal " (Vol. II., p. 19).

The blood may filter along the course of the vessels and thus get within the capsule of the kidney and thence break into the calyces. It will be seen from Fig. I., Plate I., in Chapter I., that the relation of the small branches of the renal artery to the calyces readily explains their rupturing into the renal cavity and the escape of fluid blood thence along the infundibulum and ureter. If the blood is really extravasated within the renal capsule it may either break down and disintegrate the parenchyma and
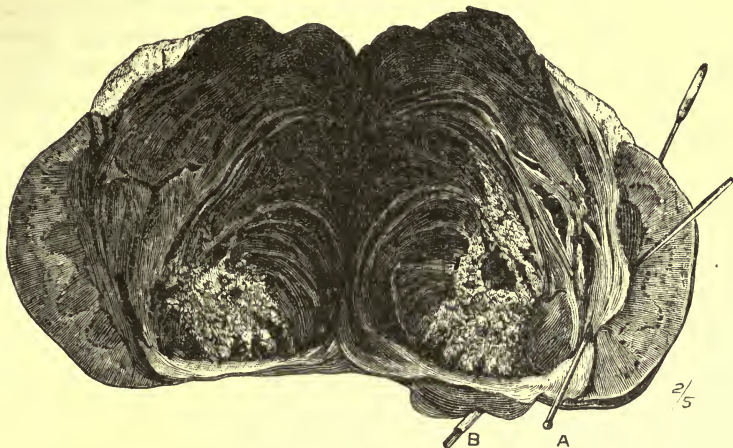

Fig. 32.—Dr. W. W. Keen's case of Aneurysm of the Renal Artery.

Right and left are the two halves of the kidney ; the whole central mass is the aneurysm, filled chiefly with laminated clot. A, Probe, showing where the renal artery communicates with the sac of the aneurysm ; B, probe in the pelvis of the kidney and the ureter. (Reproduced from the *Phil. Med. Journ.*, May 5, 1900.)

rupture the capsule, or spread between the parenchyma and the capsule (Armstrong's and Rouppe's).

If the capsule is stripped up from the parenchyma the latter may be undamaged except that its outer surface will be slightly roughened, or eroded ; but the capsule may be greatly distended and even ruptured, and thus blood may escape into the peritoneal cavity (Armstrong's case) as well as into the retro-peritoneal tissue.

The tumour may displace and become extensively adherent to neighbouring structures. The colon is commonly displaced towards the median line ; the liver and spleen are pressed upwards and the diaphragm may be raised. Some of the adhesions of the sac wall may be loose and easily separated ; others may be so dense and strong that they are absolutely inseparable—as

was the case between the sac and the diaphragm, and the sac and some parts of the peritoneum, in my own patient.

The contents of the sac are for the most part blood-clot; there is sometimes only a very little fluid blood or blood serum, so that not more than a drachm or two can be drawn off when the tumour is tapped in the course of exploring it.

The clot in the sac is of different ages, colour, and consistence. In some cases it has been found nearly all laminated; in others chiefly passive; in others again disintegrated.

When a sacciform aneurysm and a blood tumour co-exist the source of the blood which forms the tumour is not always the vessel upon which the small sacciform aneurysm is situated. The blood may be derived from a ruptured vein or from torn vessels in the parenchyma (Reeves's); neither the artery on which the aneurysm is situated nor the small aneurysm itself being lacerated; they are therefore not in communication with the perinephric blood tumour, and not the source of the hæmaturia.

The blood may be derived from the vessel on which a small aneurysm is situated, and not from the aneurysm itself (Hilton's case). When this is so, two aneurysmal conditions really co-exist in connection with the same vessel, namely, a small sacciform aneurysm and a large false aneurysm.

The perinephric tumour co-existing with the small sacciform aneurysm may be composed partly of blood and partly of urine, the blood being derived either from the aneurysm or from the artery on which it is placed, or from a different source altogether; the urine comes from a lacerated renal pelvis or calyx (Reeves's and Hilton's cases), or from the ureter.

Either a spontaneous (Gossett's) or a traumatic (Oestreich's) aneurysm may burst into the renal pelvis. In Daniel Nebel's case, as well as in Armstrong's, death was caused by the rupture of the aneurysm into the peritoneal cavity.

Both local and general peritonitis have been caused by the aneurysm; and in Hilton's case there was a slough with a perforation in the peritoneum over the tumour.

Symptoms.—An unruptured sacciform aneurysm gives rise to no clinical symptoms, and is only discovered at the post-mortem examination of a person who has died of some other disease, or from some other effect of the same accident which caused the aneurysm.

If it is possible that a small unruptured aneurysm no larger than a haricot bean may assist in producing atrophy of the kidney (Leudet's and Danner's cases), this nevertheless would be unattended with any clinical signs.

A false aneurysm, no matter how formed, whether traumatic or spontaneous, probably always causes sooner or later a tumour, and nearly always gives rise to hæmaturia. There are no symptoms other than these, which are commonly due to the rupture of a sacciform renal aneurysm, or of the wall of the renal artery itself.

Tumour.—A tumour was detected during life in fourteen out of nineteen cases, and in one other it is quite certain that some enlargement must have been present. The size of the tumour varies from that of a double fist to a swelling which fills half the abdominal cavity, reaching vertically from the false pelvis to the dome of the diaphragm, which it pushes upwards, and laterally from the side of the flank inwards as far as or beyond the median line, forcing the loin backwards and outwards and the abdominal parietes forwards.

The date of its appearance and the rate of its growth vary according to the degree of resistance of the tissues into which the blood is infused, and the extent and firmness of the coagulum which for a time may close the rent in the vessel or the aneurysmal wall. In one case (Rouppe's) which ended fatally and suddenly on the tenth day—no doubt from the rupture of the false aneurysmal sac which was formed by the capsule of the kidney—the tumour was only detected a few hours before death. When the extravasation is into the perinephric tissue, it does not follow that the tumour appears earlier and grows more rapidly than when it is within the capsule of the kidney. If the first effect of the injury is the formation of a small sacciform aneurysm or of a rent in the vessel wall which becomes plugged by coagulum, all the immediate clinical symptoms due to the accident may pass off, and the patient may be dismissed as quite well, and a long or short interval may elapse before any signs whatever of a tumour are detected. On the other hand, the presence of a swelling may be detected at once, or within a few days after the injury, as in Hahn's case and my own.

It is possible that a small aneurysm might rupture into the renal pelvis or a calyx. and cause death by hæmorrhage without giving

rise to a tumour : unfortunately, in one case in which death was
brought about in this way, no description of the aneurysm, is
supplied (Gossett's). In Oestreich's case of traumatic aneurysm,
where hæmorrhage into the renal pelvis occurred, there was a
large tumour in communication with the renal pelvis.

The tumour, on bedside examination, is generally neither
irregular nor nodulated on the surface, and no case is related
where the kidney formed a projection upon the tumour, as it
does sometimes in perinephric extravasations * and in some new
growths of the kidney or adrenal. The tumour is but slightly
movable if it is not actually fixed ; it rarely, if ever, moves
with ordinary respiration, or with change of posture, though in
several of the cases there has been some antero-posterior mobility
on bimanual examination (*ballottement*). The abdominal parietes
may be tightly stretched over the tumour, but have no appear-
ance of being adherent to it or infiltrated by it. No enlarged
veins in the parietes, no recently developed varicocele such as
is seen in some cases of new growth of the kidney and adrenal,
no œdema (except a slight degree in Dourlin's case) and no
marked redness have been observed in any of the recorded cases.

Pain.—The tumour is not generally tender on pressure or
the seat of acute pain. On the other hand, it may give rise to
insupportable pain, as in Dourlin's and other cases. If it attains
to a great size it may cause some discomfort or a dull aching.
In one case pain in the loin occurred for three months before a
tumour was detected : in another there was severe pain in the
sacral region from time to time, especially on sitting. Pain and
tenderness may exist if localised peritonitis is present. In Gossett's
case the tenderness over the kidney of the affected side was so
great that the patient could scarcely bear the pressure of her
clothes. In most of the cases there was severe pain immediately
after the injury which caused the aneurysm. In Dourlin's case
retraction of the testes on the side of the aneurysm was a
marked symptom.

Hæmaturia.—This is a very common symptom, and the next

---

* This was a feature in a case of perinephric abscess referred to further
on in this work ; and also in a case of ruptured abdominal aneurysm reported
by the author in the twenty-second volume of the Pathological Society's
Transactions, p. 105 (1871).

most important to tumour. Indeed it may be the most important symptom, and may possibly be fatal before any tumour has been formed.

More frequently than tumour, hæmaturia is the earliest symptom, and may precede a tumour by many months or even a year or two. It may commence immediately and go on for months after the injury, or to the end of life ; or, beginning at the outset of the case, it may cease after a day or two, and remain absent for months ; in my case it commenced immediately after the injury, continued for five months, then ceased and did not reappear, though the patient survived for four and a half years longer. It may not commence, however, till long after a tumour has been known to exist, as in Keen's case of spontaneous false aneurysm, and then it was but a trace, and only noticed on one occasion. A small sacciform aneurysm may rupture immediately into the renal pelvis, or a false aneurysm may open by ulceration into it, and then the hæmorrhage may be profuse and fatal. There may be hæmaturia, without any direct communication between the renal pelvis and the aneurysm, by the extravasated blood burrowing inwards from the hilum and breaking into a calyx or disintegrating the parenchyma. Hæmaturia may be coincidental and not directly connected with the aneurysm, but may arise from other injuries to the kidney, as probably was the case in Reeves's patient.

When the hæmorrhage is very profuse the blood may flow away freely through the bladder and out of the external urethral meatus, or long clots may be extruded from the urethra ; if this happens in the female it may be mistaken for uterine hæmorrhage or bleeding from the genitalia (as in Gossett's and Oestreich's cases) unless a careful examination is made.

Pulsation.—This symptom, so characteristic of most other aneurysms, is remarkable by its absence in renal aneurysm. In one case (Daniel Nebel's) pulsation was detected and the case was diagnosed as an aneurysm. In only two other cases (Hahn's and my own) was it at all suspected to exist, and in each of these it was very indistinct, if present ; in neither instance could it be made out on most careful palpation of the tumour just before and during the operation. In Gruber's case it is stated there was no pulsation, neither were there any auscultatory signs.

As Keen has remarked, "the chief reason why the diagnosis has not been made is that the artery is relatively small and the sac very large, hence the impulse of the blood is not sufficient to distend the large sac and produce pulsation."

Auscultation.—Observation on this point seems only to have been made in one case besides my own, and in that case no bruit was detected. In my patient's tumour there was no thrill, but there was a loud systolic bruit over the tumour, best heard in front, but which did not extend along the vessels towards the groins.

The urine.—Except for the presence of blood, or of a little albumen in the intervals between the attacks of hæmaturia, the urine is normal. If some independent disease affects the kidney, or if pyelitis follows a laceration of the kidney caused by the same accident which produced the aneurysm (Reeves's case), then albumen, renal casts, or pus may be passed. Dysuria and frequent micturition have been noted when blood-clots were passing or when the bladder was filled with blood or decomposing blood-clot, and also in Dourlin's case, in which hæmaturia is not mentioned as having occurred.

The general symptoms. — These are only such as would be expected from the loss of blood and the pressure effects of the tumour.

Loss of strength, loss of flesh, pallor, nausea, with or without vomiting, and gastro-intestinal disturbances, such as loss of appetite, indigestion, flatulent distension and constipation, have been complained of by some, but by no means all the patients. Rigors, fever, and rapid emaciation do not occur, unless indeed the so-called " bilious attacks " with high temperature described in Keen's case can be ascribed to the aneurysm, which is most improbable.

Diagnosis.—As a small sacciform aneurysm, so far as is at present known, causes no symptoms whatever, the question of diagnosis in such cases does not arise. I should not be surprised, however, if, as time goes on, the symptoms attributed to renal calculus prove on exploration to be in very exceptional cases due to a small aneurysm of the renal trunk or one of its branches.

It is the tumour caused by a false aneurysm which gives rise to the difficulty of diagnosis. The affections with which it is most apt to be confused are renal and adrenal new growths, true

and false hydro- or hæmato-nephrosis, and ruptured kidney. The history of an injury is of but little help when the tumour occurs a few months after a fall unless there has been continuous hæmaturia or frequent recurrences of hæmaturia ever since the accident, because malignant growths are also apt to follow injury. Neither is hæmorrhage, no matter how profuse or how bright the blood which flows, in favour of aneurysm as distinct from renal new growths, especially new growths in the renal pelvis (see case, Chapter XXII., on Tumours of Renal Pelvis (Vol. II. p. 9). Nor does the rate of increase of the swelling render much assistance in distinguishing the one from the other. Pain and tenderness, rapid emaciation, large veins on the abdominal parietes, varicocele recently developed, and the presence or suspicion of a malignant growth in some other part or organ would point to malignant renal or adrenal tumour. *Hydro-nephrosis* is usually more elastic if not fluctuating, often intermits contemporaneously with marked variations in the quantity of urine passed, is in many cases very painful or even agonising at the times of great distension of the kidney, is seldom, if ever, accompanied by hæmaturia, and is never attended by profuse hæmorrhage; and more frequently than not it is unassociated with any history of injury.

Hæmato-nephrosis develops quickly or even suddenly, and, it may be, quite independently of any injury; gives rise to intense pain and much constitutional disturbance, and has most likely been preceded by the symptoms of some other renal affection, such as tumour, calculus, or ureteral obstruction; but the true hæmato-nephrosis, it should be remembered, may be really a false aneurysm, either of traumatic or spontaneous origin. The following case is an example of a traumatic aneurysm, confined entirely within the renal capsule and really constituting a hæmato-nephrosis. It was communicated by M. Danyau, and commented on by Rayer * .

A young workman, aged fifteen, was taken to the Hôtel de Dieu in the early part of October, 1835; the anterior region of the left kidney had been contused against a counter; after this he passed blood with his urine. Some time afterwards, the hæmaturia for a while having ceased, he suddenly voided from three to four " palettes " of pure and bright blood. On the 19th of

* Rayer's " Traité des Maladies des Reins," vol. i., p. 280.

November a remittent tumour was felt in the hypogastrium and left flank, and seemed to be elongated in the direction of the ureter. The bladder contained clots of blood; there was retention of urine, and catheterisation was very painful; and the tumour, without becoming more painful, was more prominent and larger. He died on the 26th of November. At the postmortem the tumour consisted of the kidney, its pelvis, and the commencement of the ureter, greatly distended and filled with a mass of black coagulum which had already commenced to decompose. There was no trace of either pyramidal or cortical substance of the kidney left; they had both disappeared as the result of intrarenal pressure caused by the effused blood. On examining the interior of the sac with care, the orifice of a renal artery, plugged by a clot, was discovered. The walls of the tumour were formed by the fibrous tunic of the kidney and the condensed layers of the surrounding cellular tissue. The lower end of the left ureter, and the kidney and ureter of the right side, were healthy; the bladder was healthy, and moderately distended with clear urine. In the *Gazette des Hôpitaux*,* 1849, p. 148, Mounier reports a similar case, which he describes as a "hæmato-nephrosis."

In *false hydro- or hydro-hæmato-nephrosis* following ruptured kidney, the tumour, as in *true* hæmato-nephrosis, is generally developed very rapidly, is attended with great pain, and if the renal cavity is opened there is a diminished amount of urine passed naturally; the urine at a later stage will probably contain pus if the patient survives. There is too, in these cases, generally much more shock at the time of the injury and a great deal of constitutional disturbance, with rigors, high temperature, and suppuration when the condition has advanced.

It must be borne in mind, however, that perinephric extravasation due to injured kidney or ureter is sometimes delayed for weeks after the accident; and, on the other hand, a hæmatoma from a ruptured renal artery (that is, a false aneurysm) may commence to form from the moment of the accident.

In the absence of pulsation in the tumour, there is absolutely no way that I know of, except by an exploratory operation, to distinguish a simple hæmatoma or a true hæmato-nephrosis

---

* *See* also Bloch's "Thesis," p. 85.

due to a ruptured vein or ruptured renal parenchyma, from a hæmatoma or a hæmato-nephrosis due to a ruptured artery; *i.e.* a primary false aneurysm. A cancer of the kidney may pulsate (see *post*,. p. 537).

If some weeks or months after an injury, and perhaps after a period of apparent health, a tumour develops having the characters above described, a suspicion of renal aneurysm ought to be aroused, and the treatment ought to be directed accordingly.

Prognosis.—This is most unfavourable in false aneurysm : all the cases hitherto reported which have not been operated upon have died. Only four have been operated upon, and three out of the four recovered.

The three successful cases are Albert's, Hahn's, and Keen's. The two former were of traumatic origin. Keen's was a spontaneous false aneurysm. In the unsuccessful case the operation was rapidly followed by a fatal result. This may have been in part attributable to the nature of the operation employed, but the enormous size, and the firm adhesions, and the other conditions of the tumour, would, I think, have made any operation unsuccessful.

All the patients with aneurysmal tumours not operated upon died from their aneurysms. Another case (Reeves's), where a small aneurysm was associated with a tumour caused by perinephric extravasation of blood and urine from laceration of the kidney, was also fatal, but not from the aneurysm. One patient in whom no tumour existed died from hæmorrhage, due to the rupture of the aneurysm into the renal pelvis.

In the remaining three out of the total of nineteen cases, the aneurysms were quite small, and were found in persons who died from causes other than the aneurysm.

The causes of death of the cases not operated upon have been : profuse hæmorrhage from rupture into the renal pelvis (three cases) ; hæmorrhage into the peritoneal cavity ; hæmorrhage into the retro-peritoneal tissue from rupture of the false sac ; and peritonitis. In the case in which the patient died after operation, death was due to shock and loss of blood ; but had the man not been operated upon, his life could not have been much prolonged, as the contents of the sac were beginning to break down.

Some of the aneurysms had existed a long time before death

occurred, or before the operation was performed. In Keen's case and my own five years had elapsed ; in the case of the medical man who fell from his horse, four years ; and in Hochenegg's case, two years. In Gruber's case the patient lived only ten months after the accident, and but two months after the detection of the tumour.

The most rapidly fatal cases were those in which the aneurysm burst into the renal pelvis ; in one of them—a case of spontaneous aneurysm—the first symptoms referable to the kidney were pain and tenderness, and death from hæmorrhage followed on the ninth day.

In another—a case of traumatic aneurysm—the injury happened three months before death, but the tumour was detected only three days before : hæmaturia commenced about a month after the fall, rapidly became worse, then excessive, and continued to the end of life. In Hahn's case, two months elapsed after the accident before a tumour was found, and the operation was performed a week later ; there seems to have been no hæmaturia and no albuminuria throughout, and their absence no doubt was a reason why the tumour was diagnosed as being hydro-nephrosis.

In Rouppe's case, a tumour suddenly developed with violent pain, faintness, and thirst nine days after the accident, and the patient was dead in ten hours. Hæmaturia in this case, at first considerable, had ceased some days before the tumour appeared. In Mounier's case the accident occurred on January 20th, and death followed on February 14th. In Danyau's the accident occurred in the early part of October and death took place on November 26th.

Treatment.—When a tumour due to a renal aneurysm exists, the only prospect of saving life is by nephrectomy and the removal of the whole or the greater part of the aneurysmal swelling.

The operation will in most instances have to be commenced as an exploratory proceeding, for though the surgeon may suspect an aneurysm he cannot diagnose it from a hæmatoma due to a ruptured vein or lacerated kidney—unless there be pulsation, which, as we have seen, there rarely if ever is. In other cases the tumour will be mistaken for a new growth or a hydro-nephrosis.

The course to pursue is to commence by making an oblique

incision in the loin. As soon, however, as the nature of the tumour is ascertained either the lumbar incision should be prolonged considerably forwards and the renal pedicle reached and cleared by reflecting the peritoneum inwards from off the tumour, or, what is even better if the tumour is very large, the patient should be turned over and a trans-peritoneal operation performed by opening the abdomen in front, along the linea semilunaris of the same side as the tumour, then the peritoneum should be divided along the outer side of the colon, and reflected inwards, clearing the pedicle of the kidney. The whole of the pedicle should be secured or, at any rate, the renal artery should be ligatured, before attempting to empty or remove the sac.

The nature of the tumour will not at once be revealed on exposing the sac from the loin, but it will soon be if a small incision is made through the sac wall and the contents are found to consist of laminated blood-clot. There may be very little fluid in the sac, and that of a thin pinkish or pinkish-yellow or dirty light-brown colour, which will not at all assist the diagnosis, so that a mere puncture of the sac wall with a trocar and cannula is not sufficient. If, when the sac is incised and a little of its solid contents are removed for examination, hæmorrhage occurs, the small opening should be immediately plugged with gauze and the pedicle secured in the manner just described.

It is undesirable and dangerous to proceed to remove much of the clot. All that is necessary or safe to be done is, to make a small incision through the sac wall sufficient to remove enough of the contents for diagnostic purposes, and as soon as the laminated nature of the clot is detected to cease from further disturbing the sac contents till the vessels of the pedicle are securely tied.

It was by not following this course (but by adopting the plan which John Bell employed and so graphically described in a case of gluteal aneurysm, and which I once employed successfully in a large aneurysm near the bifurcation of the carotid) that the alarming character and some of the difficulties of the operation in my case of renal aneurysm were due ; and I thus specially refer to it as a warning to others. It is the first and only case of renal aneurysm I have had to operate upon, and should it

fall to my lot to operate again in a similar case, I shall do so by the method and with the precautions I now inculcate.

The plan adopted by Albert was a nearly transverse incision from a point a little inside the mammary line outwards for about 20 cm. and passing about two fingers' breadth below the arch of the ribs on the right side posteriorly. The peritoneum was not opened, but was reflected inwards so as to expose the tumour in the hinder part of the wound. The patient was placed during the operation on his left side. Keen's operation was an ordinary anterior or trans-peritoneal one. Hahn combined the lumbar and trans-peritoneal methods.

The risks necessarily attending the operation are hæmorrhage and shock. Albert met with severe hæmorrhage from laceration of the renal artery on separating the loose adhesions. This was arrested by iodoform gauze packing and a pair of hæmostatic forceps which were left in place for five days.

Hahn on puncturing the tumour through a lumbar incision drew blood, and on attempting to loosen the inferior pole of the tumour a sudden profuse hæmorrhage occurred which he checked by packing the wound : he then proceeded by the anterior incision.

In Keen's case, which was commenced and completed through an anterior incision, the patient, in spite of the injection of the saline solution into the veins of the arm, and also of the fact that not more than four ounces of blood were lost, was "very profoundly shocked." The pedicle in Keen's case also gave some trouble, being "so broad that it had to be secured in seven different sections, the arteries being numerous and large and the veins especially enormously distended."

Another risk is the adhesions which may unite the wall of the aneurysm with the peritoneum and bowel, with the diaphragm, solid viscera and prævertebral vessels. If the adhesions are tough and firm, as they were in my patient, it may be impossible to remove the whole of the sac wall. When such tough connections are present, entire separation of the cyst should not be attempted. As much of its wall as possible should be removed and the rest left and drained.

CHAPTER IX.

PERINEPHRIC EXTRAVASATIONS, TRAUMATIC AND NON-TRAUMATIC.

THE cellular tissue surrounding the kidneys not unfrequently becomes the seat of very extensive extravasations of air, blood, urine, fæces, or pus; and great care is sometimes needed to form an accurate diagnosis as to the nature of the swelling and the precise locality of the effused fluid. In the case of air, a distended colon may be supposed to exist; in the case of blood, urine, or pus, it is sometimes very difficult, if not quite impossible, to say whether the swelling is intra- or extra-renal. This is still more difficult when the extravasated fluid is fairly circumscribed or positively encysted.

In these extravasations the kidney is often greatly involved, if it be not the original source of the fluid. A ruptured or lacerated kidney may be the cause of a blood tumour in the surrounding tissue; a ruptured renal pelvis may be the cause of circumscribed or diffused swelling due to the escape of urine; a renal abscess or suppurative pyelitis may lead to diffused suppuration or an abscess in the circumrenal tissue. On the other hand, air, blood, pus, or fæcal matter may be derived from the cæcum, colon, or other source, and give rise to a tumour in the loin or renal area of the abdomen, the kidney itself remaining uninvolved, though during life some doubt may exist as to whether it is so or not.

AIR.

Air is occasionally found in considerable quantity around the kidney after injury. In a case which was admitted into the Middlesex Hospital, the left kidney was bruised throughout and its upper pole lacerated either by the spike of some railings on which the man had fallen or by the end of a fractured rib. A very extensive emphysema involved the subperitoneal tissues

of the loin, the air having entered through a wound in the ilio-
costal space.

The source of the air is not always traceable, but its distri-
bution is often very extensive. In a case admitted into the
hospital, with fractured pelvis and rupture of the ileum just
where it entered a hernial sac, there was a large quantity of
air behind the peritoneum in the pelvis and in both loins;
it had also diffused itself along the vertebræ behind the dia-
phragm, into the posterior mediastinum and thence to the neck,
from which it spread, guided by the cervical fascia, to the
shoulders, arms, and pectoral regions. All these parts were
distinctly crepitant to the touch. There was no injury to the
lungs, and no rent in the peritoneum, and the only external
wound was a perineal incision, which had been made on account
of a rupture of the urethra complicating the fracture of the
pelvis.

Extensive emphysema of the cellular tissue of the right loin
followed the application of the abdominal tourniquet in the treat-
ment of a case of aneurysm involving the cœliac axis and superior
mesenteric artery. The small intestines were ecchymosed and
their submucous coat emphysematous in places; and at one
part the intestinal walls were very much thinned out by the
pressure. It is quite possible that the air in this case had simply
transuded into the retro-peritoneal tissues through the thinned
wall of the ileum.

Wounds of the loin, groin, and perineum, whether complicated
by wounds of the bowel or not, and fractures of the lower ribs
with injury to the lung, may be the cause of this form of extra-
vasation. Retro-peritoneal abscess opening into the bowel may
give rise to emphysema about the kidney. Decomposition may
also lead to the formation of gas in cases of retro-peritoneal
suppuration.

BLOOD.

Blood may be effused around the kidney from a ruptured renal
artery or vein; or from other wounded vessels, without the kidney
or the renal vessels themselves being injured. Violence inflicted
upon the loin is very likely to be followed by extensive extra-
vasation of blood into and far beyond the region of the kidney.

When the kidney is injured. *a. Subcapsular hæmorrhage.*—
It must not be forgotten that injuries to the loin are some-
times followed by extravasation of blood beneath the fibrous
capsule of the kidney, *i.e.* between the capsule and the glandular
substance, as well as into the abundant circumrenal cellulo-fatty
tissue, without the occurrence of any rupture of the renal capsule
itself. In a case reported by Mr. Poland,* and referred to in the
chapter on subparietal injuries of the kidney, this state of things
was found. I have mentioned cases under my own care of sub-
capsular extravasation of blood giving rise to pain and other
symptoms, though not to tumour, in the chapter on subparietal
injuries (*see* p. 150).

b. Intra-renal hæmorrhage.—It must also be borne in mind
that large extravasations of blood may take place into, and
be limited to, the renal cavity, either as the result of injury or
not, and form a tumour of large size—a veritable hæmato-
nephrosis.

Neither of these forms of blood extravasation is, however, at
present under consideration.

c. Perinephric extravasation.—It is to this condition that atten-
tion has now to be drawn.

In one of the cases in the Middlesex Hospital series, a con-
siderable quantity of effused blood was found around the kidney,
but the only evidence of injury to the kidney itself was the
presence of a little blood in the renal pelvis.

In other cases in which the renal substance is lacerated, or
the kidney is actually ruptured into two or more pieces, great
quantities of blood are rapidly poured out into the retro-peritoneal
tissues. Instances of this kind are mentioned in the chapter
on subparietal injuries.

One of the most desperate operations I have ever performed
was for a large, rapidly-increasing lumbar and abdominal tumour
which followed an injury to the kidney, and consisted of an
enormous mass of old, laminated, discoloured blood-clot in con-
nection with a torn renal artery, which had formed a large
false aneurysm, and caused almost complete absorption of the
kidney. The accident had occurred five years before the tumour
began to increase, but was followed immediately by marked

* *Guy's Hospital Reports,* vol. xiv., p. 86 ; third series.

hæmaturia, lumbar swelling and ecchymosis.* Gradually all symptoms cleared up except that a certain amount of fulness always remained in the renal region, and for over four years the patient worked on his farm. At length the hæmorrhage into the tissues recurred and a large hard swelling began to show itself, which at the time when the patient came under my observation was thought to have a slight expansive pulsation and certainly had a loud general bruit.

When the kidney and its vessels are uninjured.—It would be possible to refer to many cases in which most extensive retroperitoneal hæmorrhage has followed fracture of the pelvis or lumbar spine.

Everywhere the retro-peritoneal tissues are rich in bloodvessels, and the anastomoses between the vessels of the parietes and those of the viscera are numerous and important, both in the loins and pelvis : these vessels are not unfrequently the sole source of considerable blood extravasations.

The rupture of muscles, such as the psoas and quadratus lumborum, is sometimes the cause of most extensive hæmorrhage around and beyond the kidney. So also is the rupture of an aneurysm of the abdominal aorta or one of its large branches.

The extent of the effusion in cases of ruptured aneurysm is sometimes astounding, for the blood by degrees dissects up the peritoneum, and permeates the cellular tissue in every direction, causing the ribs and loins to bulge outwards ; it may also carry forwards the posterior and lateral layer of peritoneum and the abdominal viscera, so that the abdomen protrudes in front ; and the blood may, moreover, descend along the psoas and iliacus until a fluctuating tumour is formed in each groin, even below the level of Poupart's ligament. There usually is not the least pulsation in such swellings, and unless the clinical history of the case is known, the diagnosis is very difficult, if not actually impossible. In some cases there has been an attack of syncope to mark the bursting of the aneurysm ; but life may continue long after the rupture, and the slow course of the disease, with the absence of every characteristic sign of aneurysm, will probably lead to the supposition that the swelling is malignant.

* The case is reported at length in an article on "Aneurysm of the Renal Artery," in the *Lancet* for October 6th, 1900.

Erosion of the vertebræ from pressure of the aneurysm may give rise to more or less pain, or even to some degree of flexion of the thigh, and then there is a risk that the swelling in the loin and groin or iliac region may lead to the mistaken diagnosis of perinephric abscess, or lumbar caries with abscess. To open such a swelling with the view of evacuating pus would be a very serious, and might prove even a fatal mistake. Cases of ruptured abdominal aneurysm leading to retro-peritoneal hæmorrhage are recorded in the *Transactions* * of the Pathological Society of London.

In a case † which I reported to this society an enormous tumour, adherent over a large surface to the peritoneum lining the front and lateral wall of the abdomen, had everywhere pulsated ; nothing but skin and condensed cellular tissue formed its posterior limit ; and finally it ruptured into the peritoneum, just above the cæcum and the right kidney. The kidney and the vena cava were pushed far forwards, so as to form part of the front limit of the tumour.

Another case in which the kidney was raised so completely by the extravasated blood from a ruptured sacculated aneurysm of the aorta as to present a tumour anteriorly in the hypochondrium, is described by Silcock.‡

A somewhat similar case of a ruptured aortic aneurysm giving rise to an extensive retro-peritoneal extravasation of blood is recorded in vol. i., p. 80, of the Pathological Society's *Transactions*. In this case there had been long-standing pain in the left loin, the urine was albuminous, and a fluctuating, pulsating tumour expanded the false ribs ; the left lumbar region also was occupied by the tumour, and the left kidney was displaced forwards in front of the extravasated blood.

Retro-peritoneal hæmorrhage is sometimes produced by ulceration into a vessel due to pressure of an abscess or a tumour. I have recorded a case § in which a stricture of the œsophagus set up suppuration behind the diaphragm, and death resulted from hæmorrhage from the aorta, the coats of which were ulcerated through just above the cœliac axis.

* *See* especially vols. i., iv., xix., xxi., xxii., and xxxiv.
† *Trans. Path. Soc.*, vol. xxii , p. 104.
‡ *Trans. Path. Soc.*, vol. xxxiv.
§ "The International Encyclopædia of Surgery," vol. v., p. 952 (New York, 1884).

Sometimes the cause of the hæmorrhage is not cleared up at the post-mortem examination, as in the case of a woman, aged thirty-eight, who died in the Middlesex Hospital of cancer of the vagina and uterus and secondary deposits in the pelvic glands and the lungs, who had a hæmatoma the size of a fœtal head in the left renal region.

Symptoms.—The symptoms vary with the cause and extent of the. extravasation. When the blood occupies the cellular tissue of one loin, chiefly or entirely, it causes a tumour sometimes difficult to diagnose from a distended kidney. When the extravasated blood, coming from an aneurysm of the aorta, crosses the spinal column and occupies the whole space between the outer edge of one quadratus lumborum and the outer edge of the other, the whole of the back part of the peritoneum, and with it the viscera and prevertebral large vessels, are raised forwards, the whole abdomen becomes distended, and prominent in front, and one or both kidneys may project and form a tumour on the anterior aspect.

There may be no symptom to indicate the onset of the extravasation. Even when the source of the hæmorrhage was a ruptured aneurysm, there has been in some cases nothing to mark the giving way of the sac. In other cases there has been an attack of syncope at the moment of rupture, but soon recovered from ; and subsequently the blood had been effused gradually and over a period of many weeks, or perhaps months, before death.*

Sometimes the character of the pulsation is decisive, although the position and outline of the tumour resemble very much a true hæmato-nephrosis. Such a case is described by Sir Henry Thompson in the fourth volume of the Pathological Society's *Transactions* (p. 110, case 22).

The amount of blood extravasated has been greatest in cases in which the aneurysm has been seated at, or at some spot above, the origin of the renal arteries.

The blood extravasated is of course as really lost to the individual as if it had escaped through an open wound, but as the effusion is gradual the downward tendency of the patient is gradual also ; or the primary hæmorrhage may be followed by

---

* *Trans. Path. Soc.*, vol. i., p. 86.

a long period without further extravasation, and then a sudden or gradual increase in the tumour may commence. If the increase be gradual, it may steadily continue, until the life and strength are slowly worn away. The lamination and characters of the clot found in the tissues after death in several of these cases show that the blood must have been effused gradually, and for many weeks or months, before life terminated.

In some cases symptoms of acute or chronic peritonitis have been excited.*

When the extravasation is the result of a blow upon the loin the symptoms will depend upon the rapidity and extent of the hæmorrhage. If the source of the bleeding is a superficial laceration of the kidney, or a rupture of a lumbar artery, or of one or more of the anastomosing branches in the circumrenal cellular tissue, some days or weeks may be required before the effusion is sufficient to give rise to any swelling or increased dulness in the loin, and no syncope or any sign of faintness is noticed at any time ; then after some days the effused blood becomes more solid, and the tumour more irregular, and by degrees perhaps it is absorbed.

In other instances, after becoming harder, partly from coagulation and partly from inflammatory effusion around, the blood and clot may disintegrate and be even softer than at any previous time. Under these circumstances the symptoms of suppuration will arise.

When the pelvis of the kidney or one of the calyces is opened, and urine mingles with the extravasated blood, the swelling and dulness of the loin are much more likely to be rapidly developed, and suppuration sooner or later is very likely to occur.

Marshall † recorded a typical case of suppurating hæmatoma, in which probably the renal pelvis was ruptured, as there was urine mixed with the blood. Though the tumour in this case was due to injury, the symptoms were much the same as in cases in which the extravasation was due to a ruptured aortic aneurysm, namely, severe pain in the flank passing inwards towards the umbilicus, and also affecting the lumbar spine ; pain increased by movement, improved somewhat by rest, but not disappearing

---

* *See* case by Murchison, *Path. Soc. Trans.*, vol. xxi., p. 136.
† *Trans. of the Roy. Med. and Chir. Soc.*, vol. lxvi., p. 311.

entirely; capacity, withal, of getting about; absence of hæmaturia, or other urinary trouble, from first to last; great exacerbation of pain after many months; swelling and tenderness in the left lumbar region and left half of the abdomen; fluctuation across the tumour, which was dull on percussion; pain along the thigh, increased by extension of the limb; pallor; anxiety of features; emaciation, and tendency to death by anæmia. There is this most important difference, however, that in the traumatic case life was saved, and a satisfactory result ultimately obtained, by surgical treatment.

When the kidney is completely ruptured and the hæmorrhage is both rapid and extensive, there are all the signs of great loss of blood, collapse, syncope, pallor, cold sweats, restlessness, blueness of the extremities, anxiety, vomiting, thirst, feeble, rapid, and irregular pulse, unconsciousness, and death.

Diagnosis.—It is sometimes difficult, if not impossible, to distinguish during life a tumour formed by an effusion of blood behind the peritoneum and in connection with the kidney, from a swelling caused by the kidney itself when dilated with blood or urine and blood. Though extrarenal hæmorrhages frequently give rise to a swelling soon after the accident, which is generally not circumscribed; and though the tumour, caused by effusion of blood, or by retention of urine within the cavity of the kidney, is circumscribed, and is generally formed slowly and after a somewhat prolonged period; yet the extrarenal hæmorrhages are sometimes quite circumscribed, and do not present any noticeable swelling for many months after the onset of the extravasation; and, on the other hand, a hæmato-nephrotic tumour may be very rapidly developed.*

The diagnosis has also to be made first as to the nature of the fluid extravasated — whether blood or urine; and secondly, if blood, whether its source is an injured kidney or a renal vessel on the one hand, or, on the other hand, some vessel altogether independent of the kidney. This second point is important because of the difference in treatment of the cases in which the kidney is ruptured, and of those in which the hæmorrhage is caused by the giving way of an aneurysm of the aorta, the cœliac axis or one of the mesenteric arteries.

* *See* article on "Renal Aneurysm," *Lancet*, October 6th, 1900.

The nature of the fluid.—The extravasated fluid will probably be urine; and the renal pelvis or ureter will probably be lacerated if after an injury there is little or no hæmaturia and the quantity of urine voided naturally continues to be much below the normal. After any severe injury attended with shock the secretion of urine may be temporarily suppressed or reduced; but after this stage has passed, the amount of urine reaching the bladder may be reduced nearly one-half if there is a free escape for it through a rent in the renal pelvis or ureter.

The rate of increase in size of the lumbar tumour under these circumstances may be to a degree in proportion to the reduction in the quantity of urine passed naturally; and this may be the case whether the urine begins to escape into the tissues immediately after the injury, or, owing to the wall of the renal pelvis or ureter being but partially torn through in the first instance, or to temporary blocking of the rent in them, the escape of urine does not begin until some days or weeks after the accident (*see* author's case, Part II., Vol. II., p. 348).

It is probable that the extravasated fluid will be blood, and the renal parenchyma or a branch of one of the renal vessels will probably be ruptured if after an injury profuse or marked hæmaturia occurs, especially if the passing of blood continues for several days in succession, or recurs after a period of rest, on the patient making any physical effort; if immediately after the accident the symptoms are those of shock with internal hæmorrhage; or if after a day or two ecchymoses are seen in the lumbar or lateral abdominal region.

The source of the hæmorrhage, whether from the kidney or a ruptured aneurysm.—Should faint expansile pulsation be detected —no matter how faintly marked, and no matter how long after an accident—in a tumour following an injury which caused a hæmatoma at once or soon after the accident in the situation of the kidney, the inference to be drawn is that the trunk of the renal artery or one of its main branches has been partially or completely torn across, and that a false renal aneurysm has resulted.

A hæmatoma, whether it pulsates or not, will probably be due to the rupture of an aneurysm of the aorta or of one of its large branches (other than the renal artery) if in the entire

absence of history of injury the extravasation occurs in a person who
has been previously failing in health, and who has been complaining
of gastro-intestinal disturbances, or nerve and pressure symptoms
referred to the abdomen ; or if an aneurysm is known to have
existed and a sudden attack of abdominal pain, attended or not
by syncope, is followed by a retro-peritoneal swelling. It is a
very noteworthy fact that ruptured aortic aneurysms seem as a
rule to give rise to pulsation in the extravasated retro-peritoneal
blood mass ; whereas false aneurysms of the renal artery do not.
Also that the former raise the kidney forwards and cause it
to present as an obvious tumour or swelling in front of the
main swelling ; whereas this condition has not been observed in
any one of the recorded cases of renal aneurysm (*see* p. 246, and
the article in the *Lancet*, October 6th, 1900).

Prognosis.—Recovery may take place after very extensive trau-
matic hæmorrhage ; but retro-peritoneal hæmorrhages due to rup-
tured aortic aneurysm are certainly fatal in course of time, though
death may supervene very slowly, as the cases recorded above prove.

Recovery, or what may seem like recovery, may take place,
the extravasated blood remaining unabsorbed, but more or less
consolidated, but there is always the risk that some complica-
tion may arise. Recovery may occur after suppuration and
the discharge of the matter through a spontaneous opening or
an incision through the loin.

If the hæmorrhage increases, or if suppuration follows and
surgical aid is not invoked, death will occur from peritonitis
due to tension upon or rupture of the peritoneum ; or the colon
may be penetrated and fæces and flatus may enter the blood
tumour and give rise to decomposition, septic absorption, and
death from septicæmia.

Treatment.—When the hæmorrhage is due to ruptured
aortic aneurysm, little or nothing in the way of treatment will
avail. When due to injury to the kidney the treatment must
be based upon the principles stated in the chapters on injuries
to this organ. When due to a false aneurysm of the renal
artery or one of its main branches, an operation is urgently
indicated, and the involved arterial branch should be ligatured
if it can be isolated. If the trunk of the renal artery is involved,
or if the kidney be much damaged either by the original injury,

or as the result of pressure by the blood-clot, the kidney should be removed after ligaturing the renal pedicle (*see* p. 253). The kidney will very likely be flattened and spread out on the wall of the aneurysmal sac and may not be recognisable, and in that case it will not be removed unless the false aneurysmal sac be practically or completely dissected out. Such a dissection it may not be desirable to attempt owing to the adhesions of the sac to the diaphragm and to neighbouring organs. If owing to the history and the presence of pulsation or other symptoms a renal aneurysm is suspected, it would be safer to commence the operation with an abdominal incision, through which the aorta might be compressed by an assistant, or the renal artery ligatured before the removal of the blood-clot through a lumbar incision is attempted.

If the tumour is so large as to overspread the front of the vertebral column and to render the compression of the abdominal aorta impossible; or if the exact nature of the case is not suspected or ascertained until the tumour is cut into, some of the clot must be removed and a way thus made for the hand of the surgeon to be pushed towards the renal pedicle, or towards the opening of communication with the renal artery; and in this manner the hæmorrhage must be controlled until the clot has been cleared out and a ligature can be applied to the artery (*see* author's case in the *Lancet,* October 6th, 1900). Such an operation, however, will tax the skill and resources of the surgeon, and is one of the most desperate which he is likely to be called upon to undertake.

Repeated aspiration or aspiration and drainage through a punctured opening has been successful even in suppurating traumatic hæmatoma connected with lacerated kidney (Marshall's case); but it is not a mode of treatment to be recommended in any case, and should the blood cyst communicate directly with an aneurysmal sac it can but hasten the fatal termination.

Urine.

Urine is extravasated into the loin behind the peritoneum from rupture involving the calyces or pelvis of the kidney, or the ureter; or from a direct penetrating wound of the renal cavity; or as a consequence of ulceration through the kidney.

Ulceration of the ureter, whether as a sequel of injury or of the pressure of a tumour, may also cause urinary extravasation into the loin, or iliac region. I have related a case in which a large retro-peritoneal sarcoma between the rectum and bladder, the size of a cocoa-nut, caused complete ulceration of the right ureter,* about two inches and a half above its lower end, and thus led to extravasation of urine into the iliac and lumbar regions.

Symptoms.—When urine escapes from the pelvis of the kidney or the ureter it diffuses itself sometimes very rapidly in the loin and parts beyond, and may displace forwards the liver, spleen, stomach, and intestines in the same manner as blood has ·been described above as doing. The inflammation excited in the cellular tissue may run on to suppuration, and this may be followed by pointing of the matter in the loin or groin ; or, if no infection takes place, the cellulitis will stop short of suppuration, and, becoming chronic in character, may spread slowly towards· the iliac fossa and the brim of the pelvis, and cause contraction of the ilio-psoas muscle. Under these last-named circumstances a firm hard swelling will remain in the iliac or lumbar region for many months, but ultimately may clear up, and the contraction of the iliacus and psoas and of the muscles of the anterior wall of the abdomen on the affected side will yield to gentle use and massage, or to one of the many modes of making extension.

In some instances the effused urine becomes encapsuled within a thick-walled cyst of inflammatory formation, and with the cavity of this cyst, which may contain pus as well as urine, the kidney communicates at the point of rupture or ulceration. This was the condition in one of Mr. Stanley's cases.†

Many cases of extravasation of urine into the perinephric tissue, especially when encysted, have been erroneously regarded as cases of hydro-nephrosis arising from traumatism, and the condition has therefore been designated " pseudo-hydro-nephrosis." That true hydro-nephrosis can follow traumatism is well proved, but it is decidedly a rare condition,‡ and when it does thus occur

* *See* an article on Injuries and Diseases of the Abdomen, in the fifth volume of the " International Encyclopædia of Surgery," p. 948 (1884); edited by Ashhurst.

† *Med.-Chir. Trans.*, vol. xxvii.

‡ *See* Part II., Vol. II., p. 333.

is usually consequent upon some narrowing of the ureter, and therefore does not generally give rise to symptoms until some time after the injury. A retro-peritoneal extravasation or pseudo-hydro-nephrosis, on the other hand, usually comes on soon—sometimes immediately—after the injury, as would be expected, since it depends upon an injury to the renal pelvis or ureter, through which the urine escapes ; the time which elapses before a tumour can be definitely recognised varies considerably in different cases, and no doubt depends upon the nature of the aperture in the pelvis or ureter and the ease or otherwise with which urine can pass through it.

The presence of a tumour which depends upon injury to the kidney or ureter, is frequently preceded by hæmaturia, which continues for a variable time, and may be either slight or severe.

The extravasation is a cause of pain, and there is often great tenderness on palpation ; all degrees of swelling occur, from that which merely gives rise to an obscure sense of resistance to a tumour of enormous dimensions. In a typical case a well-marked tumour can be felt, lacking the definite outline of the kidney which is obscured by it; or the kidney may be well defined and felt as a prominence in front of the tumour.

If tapped, urine, or urine and blood, will be drawn off ; but the condition frequently recurs, and repeated aspirations are necessary. Finally, after weeks or months, the tumour may cease to recur owing to atrophy of the renal substance; or, as occasionally happens, it disappears spontaneously if the free passage to the bladder is re-established.

A very large quantity of fluid is often drawn off on aspirating these cases. Thus, for instance, in a case recorded by Hicks * of a boy in whom the condition rapidly followed an injury, aspiration was performed three times, namely, on August 1st, 5th, and 8th ; two pints were drawn off on the first occasion, and two quarts on each of the others ; after the third operation there was no recurrence, and a good recovery resulted. This case illustrates also the rapidity with which recurrence can occur. The urine is naturally, in the majority of cases, aseptic at the time the extravasation takes place, and therefore, unless septic infection subsequently spreads from the bowel or elsewhere, suppuration will not supervene.

* *The Medical Record*, April 17th, 1880.

One feature which is sometimes noticed in cases of urinary extravasation from the kidney must be mentioned, because when it occurs it forms a serious complication in the treatment by lumbar incision, and sometimes has seemed to necessitate nephrectomy. This is the deposition of phosphates from the urine in large amounts on the walls of the cavity into which the urine is effused. These deposits are large enough to block drain tubes, and have occasionally to be removed in masses as large as beans or hazel-nuts in order to maintain a free discharge of pus and urine through the opening which has been made by the surgeon. Barker's case[*] affords an illustration of this : the pelvis of the kidney had been ruptured, and the lower end of the kidney formed part of the wall of the urinary abscess, and was covered with lymph and phosphates ; frequent blockages of the drain tubes by masses of phosphates had occurred prior to the nephrectomy which was ultimately performed. The same kind of accumulation of phosphatic concretions in and around the drain tubes has been noticed many times after nephrotomy for pyo-nephrosis.

Treatment.—The proper treatment of urinary extravasation when once the diagnosis is clear consists in making a free lumbar incision, and draining. In cases in which the diagnosis was uncertain, but from the fulness and dulness of the loin there was reason to think that urine was escaping behind the peritoneum, the aspirator needle has been used by inserting it at the spot where the fluid was suspected to be present. A single introduction of the needle has in some cases withdrawn all the fluid, and convalescence has forthwith commenced. In other cases, where the escape continued and the swelling in the side again and again reformed, a lumbar incision and drainage has succeeded ; but this treatment by the aspirator is tedious and uncertain, and is not to be recommended. A free incision and drainage is always to be preferred ; and if the kidney is found torn across, the detached fragment should be either sutured to the broken surface of the mass of the organ, or be removed, or the whole kidney, if greatly damaged, should be taken away. A lumbar incision becomes imperative when suppuration has been allowed to occur before operating ; in this condition the formation of a free opening

[*] *Lancet*, January 17th, 1885.

ought not to be delayed. Nephrectomy will be requisite if
the kidney is greatly damaged by the original injury, or ex-
tensively destroyed by subsequent suppuration ; it may also be
advisable in certain cases in which the fistulous opening into
the kidney or its pelvis does not close after drainage, and where
the continuous escape of urine and pus from the loin is exhausting
the patient's strength by fever, or exposing him to the risks
of blood poisoning or albuminoid changes in the viscera.   When
incision and drainage are long delayed the retro-peritoneal cellular
tissue may become widely affected, and chronic suppuration
may become established.   But when an early incision down to the
kidney is made from the loin, the kidney injured by accident
(provided the injuries are not very extensive) is put into the
same position for recovering as a kidney which has been opened
for the extraction of a calculus.

Pus.

Pus may be extravasated into the perinephric tissue by the
ulceration or rupture of a pyo-nephrosis or of an abscess in the
renal parenchyma ; or by the giving way of an abscess in
some organ or tissue in the neighbourhood of the kidney.   Pus
may also burrow into the tissues around the kidney from the
cellular tissue of the broad ligament, of the iliac fossa, or the true
or false pelvis.   These forms of extravasation will be considered
in the next chapter.

Fæcal extravasation requires no special description in a work
on the kidney.   For an account of this condition the reader
may be referred to an article by the author in the fifth volume
of Ashhurst's " International Encyclopædia of Surgery."

CHAPTER X.

PERINEPHRITIS AND PERINEPHRIC ABSCESS.

By perinephritis is meant an inflammation of the cellular and adipose tissue surrounding the kidney.

Three distinct varieties have been recognised, namely : (1) Sclerosing, (2) Lipomatous, and (3) Suppurating Perinephritis.

The **Sclerosing form** is a fibrosis of the renal capsule and the fatty tissue around. In its slighter forms it may merely give rise to an unnatural adhesion between the capsule and the kidney tissue; but when more severe the kidney may lie in a shell of connective tissue, which contracts firm adhesions to neighbouring organs and gives rise to great trouble and danger if nephrectomy is attempted.

In advanced cases the surgeon may be misled concerning the size of the kidney, which on palpation often gives an impression of being considerably larger than it really is. Such kidneys may frequently be correctly diagnosed by the fact that their apparent increase in size is unaccompanied by that particular kind of mobility on palpation which the French surgeons speak of as *ballottement, i.e.* the bobbing of the kidney forwards and backwards between the hands, when it is palpated with one hand on the loin and the other on the abdominal wall in front—a movement which can be made so freely in the case of some simple enlargements of the organ.

This form of perinephritis is apt to cause, as a late result, misplacement of the kidney. This was first pointed out in connection with a case reported to the Pathological Society of London by Durham in 1861.* The right kidney weighed only two and a half ounces, was healthy in structure, but was curiously misplaced, being situated altogether above the last rib, and firmly connected with the diaphragm by dense fibrous tissue, the effect, it was supposed, of perinephritis occurring at a very early period of life.

* *Trans.*, Case 5, p. 135.

The **Lipomatous variety** (Figs. 33 and 34) is especially apt to follow some affections of the kidney itself ; a large increase of the fatty tissues results, which after enveloping the kidney penetrates it, along with the vessels at the hilum, and may in extreme cases transform the whole organ into a fatty mass (*see* Fig. 117, Vol. II., p. 73).

There is no sharp line of demarcation between the sclerosing
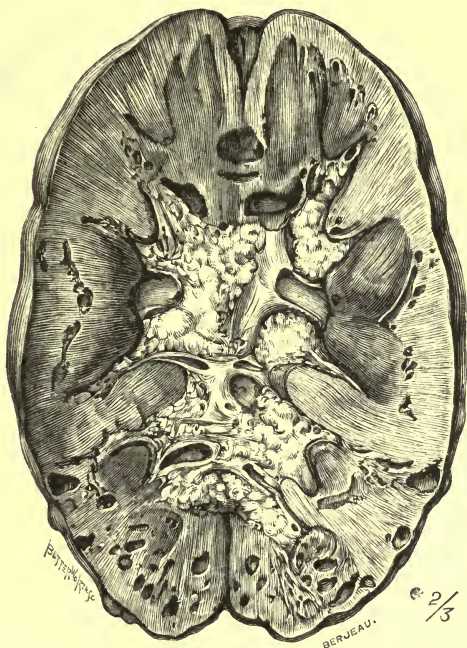

Fig. 33.—Hilum of a Cystic Kidney packed with tough fibro-lipomatous tissue, the result of lipomatous perinephritis. (Middlesex Hospital Museum.) (*This is the same kidney laid open as that illustrated in Fig.* 85, *p.* 562.)

and lipomatous varieties, and an intermediate form is often met with in which the excess of perirenal tissue is composed of fibro-fatty material.

Suppurating Perinephritis.—The third variety is characterised by the presence of pus, and it is to this form that the term Perinephritic Abscess is applied, whether the suppuration be diffused or localised.

Perinephritis has been met with at all ages, from five weeks old upwards. Perinephric abscess occurs more commonly in adults ; but as the result of injury it may arise at any age.

Though perhaps more frequent in men, the abscesses are often met with in women. In some few instances they are idiopathic in origin, and quite simple in their course and termination. In many they are symptomatic, and after running a complicated course terminate fatally.

From very ancient times renal abscess, pyo-nephrosis, and

Fig. 34.—Lipomatous Perinephritis. Suppurating Kidney firmly embedded in the cellulo-fatty tissue of the Loin.

calculous pyelitis have been known to end in suppuration around the kidney, necessitating the evacuation of pus by an incision in the loin. But it was only at and since the time of Rayer that special attention was paid to abscesses situated outside the kidney, and due to causes independent of the kidney.

It was Rayer who gave the first systematic account of peri-nephric or extrarenal abscesses. He classified them into three groups, according to their etiology, thus : (1) *Primary* extrarenal abscesses, or those which are independent of any fistulous opening

into or other disease of the kidney; (2) *consecutive* extrarenal abscesses, comprising cases in which the abscesses are secondary to an inflammation of the kidney, *i.e.* in which the inflammation has spread to the cellulo-adipose tissue by contiguity, but without urinary infiltration; (3) *consecutive* extrarenal abscesses formed in consequence of a fistula communicating between the renal cavity or renal substance and the surrounding cellulo-adipose tissue, and generally, though not invariably, due to calculus in the kidney.

Etiology.—The causes of perinephritis may be divided into two classes:—

(*a*) Primary.

(*b*) Secondary to the kidney or (*c*) to some other organ.

(*a*) Among the primary cases many are traumatic in origin. The various injuries to which the loins are liable, such as blows, strains, punctured and incised wounds, whether they involve the kidney or not, and whether urine is extravasated or not, are prone to excite perinephritis.

A sudden chill, especially after exposure to great heat, and after sweating, is an exciting cause. Rayer quotes two cases typical of this cause. In a case under my own care the exciting cause was a chill after prolonged rowing.

Perinephritis may also occur as a complication or sequela of general diseases, as tuberculosis and the exanthemata. A case of much interest, which has been quoted by many subsequent writers, was described by Dr. Butler* as due to a peculiar irritative fever, commonly called the Plymouth Dockyard disease. This seems to have been a particular form of septicæmic cellulitis.

(*b*) Perinephritis most frequently originates in suppurative pyelitis, nephritis, or pyelo-nephritis, by extension through or actual perforation of the capsule. Albarran has shown that the infection passes through the capsule by way of the lymphatics. In some cases the kidney affection is secondary to inflammation of the bladder; in others it is due to tubercle, cancer, cystic or hydatid disease of the kidney itself; in others, again, and much more frequently, to calculus within the kidney.

Urethral stricture, vesical calculus, and prostatic disease may each lead to acute or chronic perinephritis by first exciting pyelitis,

* *Edin. Med. and Surg. Journ.*, vol. xxvi., p. 106.

pyelo-nephritis, or pyo-nephrosis. Evidence of chronic perinephritis is often seen in the post-mortem examination of such diseases of the lower urinary tract as those just named, and is furnished by the induration of the circumrenal cellular tissue, and by the thickened and firmly fixed renal capsule which is left behind on attempting to remove the kidney. In acute cases of this kind the capsule is found to be very vascular, and numerous abscesses are formed in the inflamed cellular tissue around the capsule. In time these small abscesses coalesce and burrow far and wide, if they do not soon open into the colon or in some other direction.

In certain cases the spread of the inflammation has been by direct contiguity, as when numerous miliary abscesses are formed at the outer surface of the kidney* in pyelo-nephritis. In others abscess in the circumrenal cellular tissue has followed repeated attacks of the gravel or of renal colic, without there being any perforation of the renal capsule. Andral † records a case of perinephric abscess which followed chronic inflammation and atrophy of the kidney ; and Rayer (p. 264) gives the particulars of the case of a woman, aged sixty-five, who suffered from extrarenal abscess excited by a tumour of the kidney. In another case of Rayer's a perinephric abscess of the left loin followed dilatation and suppuration of the left ureter, due to a fungous cancer of the bladder.

Perinephritis, when induced by simple extension of inflammation from within the kidney, and not by extravasation following perforation, is preceded by inflammation of the fibrous capsule of the kidney.

The cases of perinephric abscess consecutive to renal fistula are chiefly due to calculous pyelitis. These are very numerous. Lafitte, in 1734, recorded three such in his article on *cases in which nephrotomy is practised with success.‡* Others arise from tubercle, cancer, hydatid, penetrating or lacerating wounds, etc.

A renal calculus, after destroying to a greater or less extent the renal structures, may ulcerate through the capsule and lie loose in a suppurating space behind the kidney. Tuberculous matter may lead to ulceration of the capsule, and sprout, fungus-

* *Bull. de la Société Anatomique*, tome i., p. 69 ; 1835.

† Andral, " Clinique Médicale," tome iv., p. 188 ; 2nd edition.

‡ *Mémoires de l'Académie Royale de Chirurgie*, tome ii., pp. 233-237. In 4to.

like, into the tissue around the kidney; or perinephric abscess may be induced by the presence of tubercle in the kidney, without the renal capsule being previously perforated.

(c) Perinephritis is often a consequence of the extension of inflammation from distant parts, such as the pelvis, colon, appendix, testicle, spermatic cord, spleen, liver, gall-bladder, or vertebræ. So easily can inflammation which begins in the pelvic or iliac regions spread upwards to the loins, along the ureter or the veins or the retroperitoneal connective tissue, and there give rise to an abscess around the kidney, that diseases of, or operations upon the rectum, urinary bladder, testicle, or the uterus, and cellulitis arising during the puerperal state, are well-known causes.

Perforation of the gall-bladder by a gall-stone (Trousseau), of the colon by a pin (Rayer, p. 247), or of the diaphragm by an empyæma or a pneumonic abscess have been recorded as causes of perinephritis. Perforation of the ileum by a typhoid or scrofulous ulcer has been thought to be an occasional cause (Trousseau); so also is appendicitis. Castration, excision of the rectum, lithotomy, the injection of a hydrocele, incision of hæmatocele, the various operative methods of treating varicocele, internal urethrotomy (Roberts), and other operations on the urethra; and diseases of the prostate, urethra, bladder, and seminal vesicles, and even the retention of a catheter in the urethra (Nieden), have each been followed by perinephritis. The inflammation extends by continuity along the retroperitoneal tissue or veins, without the kidney itself being involved.

Poland tabulated twenty-eight cases of primary abscess, the causes of which are given as follow: Falls and contusions, three; jolting of carriage, one; fatigue in walking, one; muscular effort (digging), three; debility, one; uncertain and insidious, four; no cause assignable, six; cause not stated in six cases. In three cases there is a doubt as to whether the abscesses were strictly primary or were not rather consecutive; in one of the doubtful cases the abscess occurred thirty-two days after the removal of a testicle of the same side (Chopart); in another, fifteen days after an abscess of the broad ligament had burst into the bladder and vagina; and in the third, calculi had been passed four years before, and the patient had latterly suffered from pyelo-nephritis.

In twenty-six instances collected by Dr. Duffin, two were the

result of severe injury to the loin; two had a puerperal origin; one followed a renal abscess secondary to lithotrity; one was excited by irritability of the bladder; eight were caused by kidney disease; and in twelve the abscess appeared to be independent of any affection of the urinary organs. In five of these twelve a sprain in the loin may have been the exciting cause; in three, exposure to cold; in one, ulceration of the gall-bladder.

Symptoms.—The symptoms of perinephritis are not always the same, nor are they always well pronounced, especially in the early stages of the inflammation. They vary with the cause, as well as with the acuteness of the disease. When the inflammation is secondary to some distant disease, such as puerperal perimetritis, or pelvic cellulitis, the symptoms of the primary affection may disguise those of the perinephritis. Even when perinephritis is the primary disease, the symptoms are sometimes of a most insidious, obscure, or ill-defined character, so that typhoid fever, appendicitis, hip joint disease, rheumatism, or spinal caries may be suspected rather than perinephric abscess.

It is necessary, therefore, to bear in mind that, whereas in some cases the symptoms of perinephritis are both locally and constitutionally very pronounced, and the disease is so rapid in its course that a large and fluctuating tumour in the flank may be developed in from ten days to a fortnight, in others the beginning and early part of the progress of perinephric abscess is ill-defined and slightly marked, the local pain being either absent, or neglected in consequence of a more severe pain elsewhere, or owing to the severity of the constitutional symptoms diverting observation from the local (Trousseau). It is pretty certain that sometimes cases of perinephritis which do not go on to suppuration, but recover under rest and suitable treatment, are diagnosed wrongly as incipient hip joint or spinal disease or disease of the sacro-iliac joint.

Symptoms of perinephritis without suppuration.—The experience gained by a close study of perinephric abscesses, as Gibney points out, has enabled us to recognise the symptoms of perinephritis before the inflammation has reached the stage of suppuration. When, after an injury or otherwise, there is tenderness on pressure in the renal region, and the patient whilst standing, or sitting, inclines over to the tender side, perinephritis

should be suspected. The diagnosis will be made by attention to the following symptoms.

The spinal column is preternaturally stiff, and curved in the antero-posterior direction, though without angular curvature; possibly it will deviate a little from the affected side. There is stiffness in walking, and the body is inclined over to the affected side; so much so, in some cases, that the crest of the ilium is in contact with the lower ribs.

Whilst standing, the body will be flexed upon the thigh of the affected side, and the hand of the same side will rest supporting the trunk on the corresponding thigh. The continued flexion of the thigh causes some lordosis in walking. If an effort is made to stand, without support, on the affected side, the body is thrown far over towards that side, and the opposite thigh and leg are strongly flexed. Stooping will be difficult. Whilst lying on his back the patient will not extend the thigh beyond 160°, and in more severe cases not beyond 130°. There is pain in every movement of the trunk in severe cases, so that the patient may not be able to turn over in bed. Flexion of the thigh will not give pain, but complete extension will not be possible, and its attempt will cause discomfort, if not pain. Abduction and adduction will probably be uninterfered with, but there may be some difficulty in adduction. The patient will be able to stand on the affected limb alone, in the manner described above. In mild cases the limb may look straight whilst standing, but when lying or sitting on a hard mattress the ham cannot be made to touch the surface. Occasionally the thigh is rotated outwards; when this is so, the heel of the affected side during standing rests upon the dorsum of the other foot. In this state the second stage of hip joint disease is simulated.

When knee joint pain is complained of, as it sometimes is, we must beware of mistaking perinephritis for morbus coxæ. With pain in the knee, lameness, and muscular rigidity about the hip joint, it is too often concluded that we have sufficiently strong evidence of morbus coxæ; but one of the cases reported by Gibney and another which has passed under my own observation should convince us of the necessity of cautious examination before we commit ourselves to this diagnosis on these symptoms alone.

Gibney further points out that pain at the hip joint in such acts as pulling on a boot, and resistance to complete flexion, whilst strongly in favour of hip joint disease, are not incompatible with perinephritis.

In perinephritis there is no atrophy of the muscles of the thigh, no shortening of the limb, no fulness or tenderness on pressure about the head or trochanter of the femur; no tenderness or pain on succussion or passive motion of the hip joint; no tenderness over the sacro-iliac joint, and none on percussing the spinous processes or succussion of the spinal column. The tenderness in the loin will be above the crest of the ilium, and one or two inches at least to the side of the spines of the lumbar vertebræ. The tongue will be coated, the temperature raised commonly to 103°, often to 104° or higher, and the urine will be acid and without blood or pus, though there will be abundance of lithates, and there may be some albumen.

Thus, with feverishness without tenderness over the spinal column, and with symptoms pointing to an inflammatory affection on one side of the column, there is an absence of the characteristic signs of disease of the hip or sacro-iliac joint; though a very similar alteration in the attitude, and much the same limitation of muscular mobility of the affected side, exist as in those diseases.

In non-suppurative perinephritis there is no tumefaction in the loin or around the kidney, as in perinephric abscess.

If recovery by resolution occurs, the tenderness in the loin subsides, the temperature declines gradually to 100° and then to normal, sitting is less uncomfortable, and walking more easy, flexion of the thigh is no longer maintained, and extension in dorsal decubitus can be fully and easily accomplished. The tongue gradually cleans, and the bowels act with regularity. At length all inclination of the trunk to the affected side is discontinued.

Symptoms of perinephric suppuration.—Perinephric abscess generally declares its presence by symptoms unmistakable. The *constitutional indications* are the same as those excited by deep-seated suppuration elsewhere: rigors, high temperature, sweating, furred tongue, thirst, loss of appetite, perhaps vomiting, and delirium in the acute cases; constipation, foul

tongue, loss of appetite, slight elevation of temperature in the chronic. In other words, the symptoms will be more or less severe according to the acuteness of the inflammation. In old and weakly persons, and when the inflammation is chronic, the symptoms may be altogether masked until the abscess, by its size and pressure upon surrounding structures, forces itself upon attention. In some subacute cases the only symptom for several weeks before pus was discovered, or even suspected, has been lameness, wrongly attributed to morbus coxæ or to rheumatism.

The febrile temperature does not always take the same course; in some cases it is like the course of typhoid, running continuously high; in others it is intermittent, and suggestive of malaria or pyæmia. The obstinate constipation, which Trousseau remarks always exists, is certainly a very frequent symptom, and is doubtless due to the loss of, or the dread on the part of the patient of employing, muscular effort.

Of the *local symptoms*, those due to pressure are more marked in perinephric abscess than in perinephritis. Pain is one of the earliest and most prominent indications. Deep-seated and often paroxysmal, it frequently ushers in the disease. The common seat of the pain is the loin and side of the abdomen, but it sometimes shoots down the thigh or into the hypogastrium, scrotum, penis, testes, or groin. Its wide diffusion is explained by the anatomical distribution of the nerves of the lumbar plexus which traverse the renal region.

It is in one case of a dull aching character, in another darting or pricking. Occasionally it may be felt in the knee, as in coxalgia (Gibney). In most cases the pain which sets in at the beginning continues and increases throughout the progress of the inflammation and until the pus is evacuated; but in other cases its severity diminishes temporarily, and in chronic cases it may disappear entirely for weeks, or even months, encouraging a delusive hope that recovery has taken place (Trousseau and Ebstein). Invariably the pain is increased on pressure, and if the loin be compressed between the hands the suffering caused is, in some instances, very acute. For a period varying from a few days to several weeks no other local symptom except pain or tenderness on pressure over the kidney and in the loin may be present; whilst the constitutional disturbance

may or may not indicate that the pain has its origin in a grave and organic disease.

The affected side will often give to the surgeon the sense of increased resistance and weight long before pus has formed or the abscess is large enough to cause any alteration in the outline of the flank or abdomen. This condition will be best detected by lifting, as it were, each loin with the flat hands placed behind, on each ilio-costal interspace ; thus simultaneously comparing the resistance offered by the two sides. A feeling of weight in the side is sometimes experienced by the patient, who will, perhaps, for days together complain of a sensation of fulness and puffiness in the flank. Later on there will be dulness in the ilio-costal interspace, swelling in the region of the kidney, at first hard and resisting, and if the parietes be thick and fat, indistinct and ill-defined ; later in the case the ilio-costal curve will be quite effaced, and obscure fluctuation may be felt. The skin in the loin is often waxen and œdematous, unless the matter makes its way to the surface, and then it becomes congested. After a time deep-seated fluctuation may be detected in place of the hard resistance previously felt ; but this will depend much upon the thickness of the abdominal parietes. I have known as many as six pints of pus pent up, presumably for several weeks, in a perinephric abscess, and yet no fluctuation could be made out, owing to the enormous thickness of the subcutaneous fat. In this case the patient had suffered and recovered from an acute abscess in the testis of the same side, before the commencement of the perinephritis ; both abscesses were caused by calculous pyelitis.

Retraction of the testis has been noticed in some cases ; it is most likely to occur when perinephric abscess is caused by calculous pyelitis, but is not restricted to such cases.

I have seen œdema of the foot and ankle precede for many weeks every other sign of perinephric abscess. Pyelitis had existed for a long time, and shown itself by a small quantity of pus in acid urine, frequency of micturition, constipation, flatulence, debility, and anorexia ; then followed œdema of the limb, without pain ; and then, after a long railway journey, came pain in the loin and in the same side of the abdomen ; the pain rapidly increased, and was followed by fulness, hardness, and dulness,

and at last by redness and œdema in the loin. Nieden gives one case in which œdema of the lower extremity was noted.

Lameness and flexion of the thigh.—A peculiar lameness is often an early symptom, and is due to the flexed position in which the thigh of the affected side is retained in order to relieve pressure upon the inflamed tissue. Sometimes the patient walks with the body bent forwards and inclined to the affected side, with the hand of the same side resting on the middle of the thigh. The sitting attitude is also, and for the same reason, characteristic ; the patient sits on one ischial tuberosity, so as to relax the psoas muscle of the other side. Dr. Duffin, in his excellent summary of twenty-six cases, has drawn particular attention to this lameness as a diagnostic sign, and points out its association with another symptom of perinephric abscesses—namely, their tendency to implicate the pleura and lung. The pus sometimes follows the track of the psoas muscle downwards towards the groin ; but it may also pass upwards along the psoas beneath the ligamentum arcuatum internum, and thus empyema or pulmonary fistula may be caused.

Sometimes the symptoms of pleurisy or pneumonia on the affected side mask those of perinephritis, and the patient appears at first to be suffering exclusively from disease within the chest (Bowditch).

An inability to extend the thigh of the affected side has also been an early sign in my experience. I will refer later on to a typical case, in which the flexion of the thigh was a very striking, but, as it happened, a very misleading symptom. It was observed in twenty-seven out of one hundred and sixty-six cases collected by Nieden. It may be only just sufficient to prevent complete extension of the thigh, or so extreme that the thigh is drawn up close to the abdomen. As long as the limb is kept flexed the patient may be easy, but any attempt to extend it causes pain. Sometimes other movements of the thigh as well as extension give pain. Gibney mentions difficulty in voluntary adduction, and in one case towards the end of the disease there was resistance to complete passive flexion. In Nieden's list there is one case in which convulsive movement of the leg was a symptom of perinephric abscess ; one in which perinephritis (not abscess) was followed by paralysis of both

legs; another in which an abscess on the left side was com-
plicated with pleurisy of the same side and paralysis of the
right arm and both legs. Altogether, in eight cases out of the
hundred and sixty-six there was some temporary anæsthesia or
more or less paralysis of the thigh of the affected side.

This bent position of the thigh, like the lameness and the
sitting on one side, is doubtless due to a relaxation of the
psoas muscle, whereby pressure and tension on the post-renal
cellular tissue are lessened and pain is thus relieved. The nerves
of the lumbar plexus pass outwards in very intimate relation
with the psoas muscle and post-renal cellular tissue, and in all
probability suffer some inflammatory thickening, and the relaxa-
tion of this muscle by flexion of the thigh tends to put these
nerves at ease. To the same end a stooping attitude is assumed,
the shoulders are elevated, and the trunk is inclined to the
affected side, so as to fix the spine and relax the upper end of
the psoas muscle.

The urine.—The urine affords but a very imperfect aid to
diagnosis, because, in the first place, it may have been long ago
changed by antecedent vesical or renal disease; and because, in
the second place, if the cause of the perinephric inflammation does
not reside in the urinary organs the urine itself may be quite
normal, except for the changes due to febrile action; or at most
there may be a diminution in the quantity excreted. It may, how-
ever, contain albumen, as a result of pressure on the renal vein.
When perinephric abscess follows an injury to the kidney region
the urine may be at first blood-stained, and afterwards contain
pus. Frequent or painful micturition and incontinence of urine
have been observed.

The frequency of urinary complications in the twenty-six cases
analysed by Dr. Duffin was as follows: Two patients had blood and
six had pus in their urine; two suffered from vesical irritation;
five had renal disease without bladder signs; twelve were without
urinary trouble of any sort. In the two in which blood was
voided with the urine the perinephric abscess was caused by
injury to the loin.

Characters of the pus.—The pus contained in some perinephric
abscesses is quite odourless, in others fœtid; in a few it has quite
a fæcal odour, though no fistulous communication exists between

the abscess and the bowel. Rayer pointed this out as occurring in one of his cases in which there was an entire absence of fæcal matter in the discharges, as well as of gas on pressing the anterior abdominal walls, and, indeed, of all signs suggestive of intestinal fistula.

As soon as the pus is evacuated the temperature falls, the pain vanishes, the appetite returns, and the flatulence and constipation disappear. The patient rapidly recovers, provided the incision of the abscess has been made before the pus has burrowed too widely or the inflammation has set up some dangerous complication.

Pathology.—The area of the cellulo-adipose tissue affected may be very small or very extensive. A purulent collection may be so small that it may be missed by an exploratory incision extending from the last rib to the iliac crest; whilst, on the other hand, pus, if not provided with an opening, may burrow upwards to the diaphragm, downwards to the groin, and inwards across the middle line to the opposite loin. In acute cases the fibrous capsule of the kidney may be very vascular and red, and the cellular tissue surrounding it may be infiltrated with serous fluid; or numerous minute abscesses may form in the inflamed cellular tissue; or the inflammation may be lighted up in the whole of the surrounding tissue at once, and suppuration be diffused throughout it.

In some cases the tissue is injected, and œdematous with serum or sero-pus; in others one or several pints of pus may have formed, and the kidney (little or not at all affected) may be detached everywhere from its cellular and adipose surroundings; in others, again, besides pus, stringy, flocculent, and gangrenous masses of the tissue have been found mixed with the pus. In Dr. T. Turner's case the tissue surrounding both kidneys was gangrenous and converted into a black pulpy mass, and the fibrous capsule of each kidney was inflamed, whilst that of the right was partly gangrenous, though the secreting substance of the kidneys was but slightly affected. The pathological changes observed in the kidney are frequently those to which the perinephritis was due; in other cases the renal changes are secondary to the inflammation in the perinephric structures. In some cases there has been found general softening of the

kidney, but without any purulent deposits in the secreting sub-
stance, or suppuration in the pelvis, or calyces of the organ.
Sometimes the whole or a part of the kidney has been quite
liquefied by the solvent action of the surrounding pus and the
softening influence of the inflammation.

In a medico-legal case of some importance which arose several
years ago in Edinburgh, a calculus (from which Fig. 29, p. 163,
is taken) had tightly fitted the cavity of the kidney of a
woman who was kicked in the loin by her husband. Acute
inflammation, followed by an enormous perinephric abscess,
occurred, and soon ended fatally. At the post-mortem examina-
tion the lower half of the kidney was quite liquefied; it had
entirely lost all the characters of a solid structure, but the calculus
had literally to be cut out of the remainder of the organ, to
which it accurately and tightly fitted.

This abscess had burrowed upwards to the diaphragm, through
which it had partially ulcerated over an area equal to a penny-
piece; and the base of the lung was firmly adherent to the
upper surface of the diaphragm over this area. Had the muscle
been completely ulcerated through, the pus would have entered
a bronchus, and not the pleural cavity. In this case the large
branched stone, weighing 337 grains, was the predisposing, and
the kick the exciting, cause of the suppuration; and thus this
unsuspected and previously quiescent calculus at length destroyed
the life of its bearer.

As previously stated, blood is occasionally effused beneath, as
well as upon the outer surface of, the fibrous covering of the
kidney, and sometimes a number of small ecchymoses are seen
in the tissue around; so, in some cases pus is found beneath the
fibrous tunic of the kidney, as well as in the cellular tissue out-
side, and the fibrous capsule may be perforated here and there,
thickened, and intimately adherent to the surrounding tissue
at points where there is no pus. Such a condition is usually
the result of some cause which has led to more or less dis-
organisation of the kidney prior to the perinephritis. Pyelitis
and pyelo-nephritis are usually associated with this condition.

The pus contained in a perinephric abscess may be dark in colour
from extravasated blood, or fæcal matter; but owing to the prox-
imity of the colon, even a fæcal odour may be present without any

fistulous communication with the bowel existing. Occasionally a urinous odour has been noticed. Among the micro-organisms which have been most frequently found in connection with these abscesses are bacillus coli and the pyogenic cocci, while in many cases there is a mixed infection.

The seat of the pus, when the suppuration is not due to extravasation from the kidney, is nearly always in the cellular tissue behind, between the kidney and the muscles of the loin, and with the kidney between it and the peritoneum.

When the perinephritis is the consequence of a renal fistula, the pus will generally be posterior to the kidney. But it may be in front of it, and, burrowing along behind the peritoneum push that membrane forwards, as in the case of Sarah S., aged thirty (Middlesex Hospital, No. 183, 1882), who died of scrofulous pyo-nephrosis and cystitis. The left kidney was large, its capsule very thick, and foci of pus were seen in places beneath the capsule, The greater part of the kidney substance indeed, was suppurating. A perinephric abscess, situated chiefly in front of the kidney, had burrowed down to the anterior superior spine of the ilium and the brim of the pelvis.

Or the abscess may ulcerate through the peritoneum, and cause death by fatal peritonitis, as in a case recorded by Gardien ; * or it may form an intraperitoneal abscess circumscribed by adhesions.

A perinephric abscess may extend from the posterior border of the liver or spleen to as low as the brim of the true pelvis ; posteriorly, it is limited by the aponeurotic and muscular tissues of the loin, which it bulges backwards and outwards, and may destroy more or less by ulceration ; and, anteriorly, it may push forwards the peritoneum, until it forms an enormous tumour, readily detected by looking at the front of the abdomen. On the other hand, in not a few instances the abscess has been so small that after an exploratory incision no pus has escaped, and the diagnosis has been for a moment called in question ; but within a few days the matter has found its way into the opening.

In some instances, though the peritoneum may be much bulged forwards, and the pus only retained posteriorly by the skin, the abscess cavity is limited above and below by a tough

* *See* Rayer, p. 252.

thick cellular tissue, which shuts off the liver or spleen above, and the iliac fossa below.   Andral describes such a case.* Occasionally an abscess in the liver or spleen, according to the side affected, is excited by the inflammation in the perinephric tissues.

In chronic inflammation or suppuration in the perinephric tissue, very firm and tough adhesions are formed between it and the fibrous capsule of the kidney, and between the latter and the cortical substance   Indeed, one sometimes finds the kidney " set," as it were, in a thick frame of cellular adipose tissue, as an anatomical preparation is " set " in plaster of Paris. In such a state it is impossible to separate the kidney without tearing it out of its fibrous capsule.   A specimen which I placed in the Museum of the Middlesex Hospital shows this condition well (Fig. 34, p. 272); and Durham reported a similar case in February, 1885. Sometimes the fibrous capsule of the kidney undergoes in places marked cartilaginous or bony thickening. In one instance, in which I laid open a chronic purulent fistula in the loin, I picked from off the capsule a small plate of plastic lymph infiltrated with urinary salts, and which, for the moment, felt like a calculus projecting on the surface of the kidney.

When incision, the only proper treatment in cases of suppuration, has been neglected, the pus may burst in one or more of several directions. In one case it will be into the colon, small intestine, or stomach ; in another, into the pleural sac or the lung ; in a third, into the ureter ; in a fourth, into the sheath of the psoas muscle, and thus make its way to the groin ; or it may reach the groin by travelling across the iliac fossa without entering the psoas sheath ; similarly, after burrowing through the pelvis it has appeared in the buttock by finding its way through the sacro-sciatic notch ; more frequently it reaches the surface at the loin or at some spot posterior to a line drawn from the crest of the ilium upwards to a point one inch in front of the tip of the eleventh rib. Compared with the frequency with which perinephric abscesses perforate the colon, the pleura, or the lung, the other forms of spontaneous opening are rare. Probably it is not any exaggeration to say that of every twelve cases

* *Clinique Médicale.*

which pursue their own course, four or five open into the pleural cavity or lung.

Duffin gives six cases out of twenty-six in which the abscess opened into the colon, one in which it opened into the peritoneum, and one only in which it opened externally at the loin. Of the twenty-eight cases of primary abscesses tabulated by Poland, sixteen were uncomplicated, five burst into the colon, one into the peritoneum, two into the vagina and bladder, three into the lungs, and three probably into the kidney. In a case recorded by Rolleston an abscess arising from tuberculous disease of the kidney opened into the third part of the duodenum.

Lidell, in an article on rupture of the abdominal and pelvic viscera,* cites a case of gun-shot wound of the right kidney and third lumbar vertebra, where an abscess was formed in the cellular tissue behind the caput coli, which burrowed along the psoas magnus and among the muscles of the abdominal wall and the back, and passing up beneath the right crus of the diaphragm, burst into the right pleural cavity, and in this way caused death. The case is worth quoting, because of the emphasis the author lays upon its being "a matter of the highest importance to secure the *early* discharge of the contents of the abscess through an external opening, since from the looseness of the cellular tissue the pus is apt to burrow widely" Quain and Dickinson have each recorded a case in which the abscess opened at the groin, and in two cases of my own, one of which will be referred to further on, the same thing occurred Dr. F. Lange has reported a case where empyema and a sinus on the front of the thigh were both apparently due to a peri nephric abscess. Bowditch gives a case of a young man supposed to be dying of phthisis, and who was expectorating large quantities of pus, which from time to time used to pour out of his mouth ; but he had also the perinephric posture and lameness, and these led Dr. Bowditch to incise the loin. Matter was reached, and the patient recovered. This is a most striking example of the value of incision.

Of the twenty-eight cases of primary abscesses recorded by Trousseau and Bowditch, eighteen recovered, eight died, and in two the result is not mentioned Of the eight

* *Amer. Journ. Med. Sciences*, p. 356 (April, 1867).

deaths, six were in cases in which no operation was performed, and death was mainly attributed to this fact. Of the only two fatal cases in which the abscesses had been opened, one died of peritonitis, quite independent of the disease, and one from prolonged suppuration and diarrhœa.

A case in several ways unusual came under the care of Dr. Coupland and Mr. Lawson in the Middlesex Hospital, on January 6th, 1883. A boy, aged thirteen, had suffered for a month from pain in the right renal region, and obstruction in the lower end of the right ureter, probably due to impacted calculus. Pyonephrosis followed, a tumour formed in the right renal region, which was opened on February 14th by a lumbar incision, and a fistulous opening was established in the loin. Suppuration afterwards completely surrounded the kidney and extended downwards, so that an opening was made in the groin on February 27th. This opening communicated with that in the loin; but at the post-mortem, no communication existed between the perinephric abscess and the interior of the kidney, nor did the sinuous fistula, which led from the pyo-nephrotic cavity to the surface of the loin just below the last rib, communicate with the abscess space around the kidney. During life a fragment of calculus had been impacted in and removed from the urethra. As pus had been freely discharged through the fistula in the loin, the sacculated kidney had become somewhat shrivelled. The kidney (the right) was devoid of its capsule, but the lining membrane of its cavity was thickened, and suppurating foci were seen in what remained of the pyramids. The calyces and pelvis were filled with caseous pus. The ureter, which was double to within three inches of the bladder, was enormously dilated throughout its whole extent, but its vesical orifice was much constricted. The dilated ureter was filled with the same kind of material as the cavity of the kidney. The perinephric abscess was full of semi-solid caseous material and green fluid pus. There was empyema of the right side, and pus occupied a space between the diaphragm and the under surface of the right lung, but there was no communication between this empyema and the perinephric abscess (Fig. 35). The left kidney was hypertrophied.

The course of events in this lad had been, no doubt, first obstruction in the vesical orifice of the right ureter, and then

pyo-nephrosis; the pyo-nephrosis gave rise to general suppurative perinephritis; lastly, empyema was set up by the contiguity of the pleura to the perinephric abscess, which was pressing upwards the right side of the diaphragm. The immediate cause of death was septicæmic pericarditis.

The fact that the ureter was double throughout the greater part of its course; that the lumbar fistula had, at the time of death, no communication with the perinephric abscess, but opened directly into the sacculated kidney; and that the abscesses connected with the kidney had no direct communication with the empyema, are striking features in this case.

Prognosis.—The prognosis is always grave. In 230 cases collected by Küster the mortality was 34 per cent. The duration of the disease varies from two or three weeks to many months. In a few cases perinephritis ends in resolution before the suppurating stage has been reached. Gibney mentions one such case of six months' duration. When suppuration occurs the prognosis depends chiefly on two things, the early and free evacuation of the pus, and the
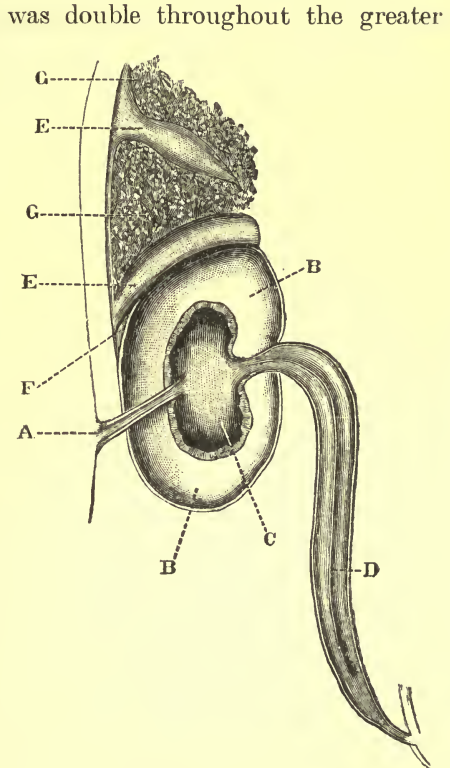

Fig. 35. — Diagram showing Perinephric Abscess.

A, Sinus opening upon the surface and into the kidney cavity; B, perinephric abscess space; C, abscess cavity within kidney; D, septum in ureter; E, empyemic space; F, diaphragm; G, lung.

cause of the disease. Incision not only saves life, but also hastens recovery; and in uncomplicated cases the recovery is complete. The tendency to open spontaneously in the loin is not great in perinephric abscess; the pus is more likely to take some less favourable direction; but even if the abscess bursts externally, it is too often not until after extensive burrowing has occurred,

and through an opening not free enough to permit of thorough drainage. Prolonged suffering, hectic, and death, are too generally the results in cases where incision is either delayed or neglected. When the abscess is primary, *i.e.* not dependent upon renal or other visceral or spinal disease, an opening into it is not only followed immediately by great relief, but convalescence is soon completed.

An incision into the loin, by diminishing the tension of the inflamed tissues and allowing of the escape therefrom of blood and serum, has sometimes cut short the inflammation ; whilst in other cases it has hastened the evacuation of the pus of a small abscess, the precise locality of which was not entered by the incision. When the perinephric abscess is secondary to calculous pyelitis, and where there is distension of the pelvis and calyces of the kidney, the lumbar incision is followed by a fistula which may remain open permanently or for a very long time. Sometimes the cure is only completed after the discharge of several calculi, or after nephrectomy.

If the abscess burst into the lung, colon, or ureter, recovery may ensue unless the cause of the abscess is incurable ; and, at any rate, immediate relief from the local symptoms will in all probability be experienced. On the other hand, fresh suppuration may be excited by the escape of air and mucus, or by the extravasation of fæces (as in a case reported by Bowditch) or urine into the abscess ; and then death may occur from pyæmia, septicæmia, sapræmia, exhaustion, or gangrene of the lung. Even in cases communicating with the intestine, kidney, or lung, relief, and even permanent and complete cure, might be obtained by lumbar incision. Hufeland* describes a case in which a pin, swallowed by mistake, perforated the ascending colon and led to the escape of fæcal matter and gas, and thus to a considerable abscess in the right lumbar region. The patient died in spite of a lumbar incision. But, Hufeland adds, these abscesses do not always terminate so ; and he then describes a similar case of fæcal abscess in the left loin of a man aged forty, which entirely healed after it was opened and drained. Nieden mentions a case of cure after an abscess of the perinephric tissue had burst into the lung and eighteen ounces of pus had been expectorated.

If the abscess bursts into the peritoneum, death from peri-

* *Vide* Rayer, p. 247.

tonitis will in all probability quickly follow; if the abscess bursts into the pleural cavity, empyema will carry off the patient. Death sometimes is caused by the pressure effects of the abscess before it is opened or has ruptured. Syncope, apnœa and other chest complications are very common in perinephric abscesses, as well as in subdiaphragmatic abscesses within the peritoneal cavity. When scrofulous disease or complete disorganisation from calculous affection of the kidney is the exciting cause, nephrectomy may afford the only chance.

In cases in which complete cure is impossible, and a permanent pus-discharging fistula remains, nephrectomy may be the only chance of warding off lardaceous disease; but, of course, this operation applies only to cases in which the cause of the abscess is in the kidney itself.

Diagnosis.—In examining a case of probable perinephritis or perinephric abscess, we have to ask ourselves *first*, how to recognise it as such; *secondly*, whether the perinephritis or abscess is primary, or secondary to renal or some other organic disease; and *thirdly*, in cases where the inflammation or abscess is very limited in extent, by what signs can we precisely localise the seat of disease?

1. *The affections which may be mistaken for perinephritis or perinephric abscess* are lumbago, nephralgia, various organic diseases of the kidney, spinal caries, appendicitis, splenic and hepatic tumours, fæcal accumulations in the colon, empyema, pneumonia and abscess of the lung, typhoid fever, morbus coxæ, sacro-iliac disease, and psoas abscess. In the early stages and in mild cases an exact diagnosis is not always possible. The following indications will, however, assist us in most cases.

Lumbago is unaccompanied by fever, local swelling, or marked tenderness on pressure; the pain is felt on both sides of the spinal column, does not extend around to the front of the renal region, nor shoot along to the groin or testis, and though it is aggravated by movements of the back, it does not cause spasmodic contraction of the psoas muscle; there is tenderness of the muscles and fascia on *pinching* those structures. Though the patient walks with a stoop and with a rigidity of the spine, there are not the flexed thigh and lateral inclination of the trunk which are seen in perinephric abscess and perinephritis.

In *nephralgia* the pain is periodic, paroxysmal and variable in degree, sometimes being almost or entirely absent, and sometimes intense; it is generally increased by fatigue or nervous depression, and in women during menstruation; it is unattended by alteration in the urine, and does not often shoot along in the direction of the ureter. There are spots in the loin which are tender on pressure; and there may · be irritability of the bladder; and neuralgic pains similar to those in the region of the kidney may be felt in the testis, in the opposite loin, or in any other part commonly affected by neuralgia. The fulness, hardness, and widespread tenderness, the continuous and daily increasing pain, the sensation of tightness and puffiness felt by the patient, and the flexion of the thigh so common in sharp attacks of perinephritis, are all wanting in neuralgia.

Organic diseases of the kidney, such as cancer, tubercle, calculus, pyo-nephrosis, and the various cystic diseases of the kidney, may co-exist with (may have, in fact, given rise to) perinephritis. The diagnostic characters of each of these are described under their separate headings or in the chapters on renal tumours, and need not be repeated here. It will be sufficient to state that pyo-nephrosis and renal cysts, though they may give rise to elevation of the general temperature of the body, do not cause an increase in the local surface heat, nor œdema of the superficial tissues of the loin; nor is the tumour in these cases so ill-defined in outline as it usually is in perinephric abscess, and fluctuation, when it can be detected, is deeper than when the pus is outside the kidney.

Disease of the spinal column.—The similarity between some cases of perinephric abscess and disease of the vertebral column is very striking, and Dr. Gibney records a case in which the spinal brace had been ordered for a patient with perinephritis running on to perinephric abscess. In spinal caries the pain extends round the trunk, and is often most felt over the pit of the stomach; it is relieved by suspending the patient; there is a sense of weakness in the centre of the back corresponding to the seat of affection; and there is increased sensibility to heat, so that the patient winces on the application of a hot sponge to the spine. The body is held stiff, with the spinal column straight, and the shoulders raised; there is no inclination or

rotation of the trunk to one side as in perinephritis. The flexi-
bility and mobility of the spinal column is lost, and the spine
moves as a whole upon the hips.

As the disease progresses the patient cannot stand upright
unsupported, the body is bent directly forwards, and is in fact
supported by both hands resting on the thighs or on a chair
or table; not by the hand of the affected side resting on the
thigh of the same side as in perinephric disease. There is diffi-
culty in standing on one leg. The walk is shuffling and tottering,
and the toes are more or less turned in. After a time one or
two of the spinous processes may become a little prominent;
tenderness or pain will be elicited by pressure or percussion
over this part of the column; and often, too, by pressing on
the head or shoulders whilst the patient is sitting on a firm
seat. When the disease has advanced to distinct deformity of
the spine, with great weakness and more or less palsy of the
muscles of the lower limbs, of the sphincter ani, and the detrusor
fibres of the bladder, there is or ought to be no possibility of
mistaking spinal disease for perinephritis.

Morbus coxæ. — Perinephritis ought to be distinguished from
disease of the hip by two classes of symptoms, positive and nega-
tive. The positive signs of perinephritis are the higher situation
of the pain; the tenderness, if not fulness, and other changes
in the loin; the fact that passive flexion of the thigh upon the
trunk is no only painless of itself but often relieves existing pain,
and is effected without any movement of the pelvis; and further,
the free and painless mobility of the hip joint in the direction
of rotation outwards and abduction whilst the limb is flexed.

The negative symptoms are the absence of fulness about the
hip joint, and of tenderness on pressure over the head and tro-
chanter of the femur; the absence of pain on percussion of the
thigh and less rigidity and spasm of the adductor and rotator
muscles of the thigh.

The symptoms of perinephritis which suggest hip-joint disease
are the pain in the thigh and occasionally in the knee, the flexion
of the thigh on the trunk and of the knee on the thigh, the
inability to completely extend the thigh without causing pain
and tilting of the pelvis, the peculiar inclination of the trunk and
the limping walk. In cases in which the pus burrows downwards

and opens below Poupart's ligament the simulation is even more complete.   A typical case is recorded in my earlier work, "Surgical Diseases of the Kidney" (pp. 235–37).

Though caution is required to arrive at a right diagnosis; and though Gibney may be right in thinking that many reported cases of hip disease followed by recovery with perfect mobility of the joint, are in reality cases of cured perinephritis, yet such a mistake ought not to be made, and will not be, if due attention is paid to the positive and negative signs mentioned above.

Sacro-iliac joint disease.—The preceding statements respecting the distinction between perinephritis and hip-joint disease apply *cæteris paribus* to this affection.

Inflammation and abscess of the psoas simulate perinephritis in the following points : pain, inability to stand upright, and lateral inclination of the trunk to relax the muscle and to extend the leg.   If, however, there be suppuration due to caries of the vertebræ, there will probably, though not always, be the symptoms of disease of the spinal column, and an examination of the evacuated pus may show evidence of disintegrated bone.   Further, the situation of the pain and swelling in inflammation of the psoas will be much nearer the middle line than in perinephritis.   In perinephritis the local symptoms show themselves in the loin and on the side of the abdomen posterior to a line drawn from the front border of the axilla to the crest of the ilium.   If the psoas abscess is large, it will descend below Poupart's ligament in the line of the psoas muscle.   Psoas abscess is not always due to spinal caries, but the course and determination of the pus will be independent of the cause of the abscess.

The case of the boy above referred to, who was under my care, shows that a perinephric abscess may burrow into the thigh and present a swelling in the groin ; but in that case the matter did not pass along the psoas muscle and beneath Poupart's ligament, but took another course and reached the thigh below the horizontal ramus of the pubis.

A perinephric or a renal abscess may, however, ulcerate into the sheath of the psoas, and then the matter follows the course of that muscle ; conversely, a psoas abscess may break into the ureter and discharge itself with the urine.*   Thus a perinephric

* Dickinson's "Renal and Urinary Affections," vol. iii., p. 670.

abscess may be the cause of a psoas abscess, or a psoas abscess may either give rise to purulent urine or burrow into the perinephric cellular tissue of the same side.

In a case under the author's care, a psoas abscess on the left side was followed by a perinephric abscess on the opposite side ; both were due to caries of the lumbar vertebræ, of the existence of which there was not the slightest evidence before the diseased bone was actually touched by the finger introduced at the lumbar incision.

Blood extravasation.—After a contusion or other injury blood may be extravasated into the circumrenal cellular tissue in sufficient quantity to give rise to swelling and pain. The diagnosis would be made by the swelling coming on soon after an injury, by the presence of ecchymosis or other evidence of violence, and by the absence of local or general signs of inflammation ; there may have been shock or collapse at first, and later on hæmaturia from hæmorrhage into the pelvis or calyces of the kidney. Extravasated blood, if not quickly absorbed, may give rise to perinephritis, and, if it becomes infected, break down, forming a suppurating swelling ; in this event the symptoms of perinephric abscess would succeed those of extravasation of blood.

Appendicitis.—The characteristic symptoms are pain, tenderness and swelling in the right iliac fossa. There is the same insidious onset in some cases, the same severity of onset in others, as in perinephritis. There is the same description of pain, aggravated by coughing and movements as in perinephritis. There is the same inclination of the trunk to the affected side, and the same flexion of the thigh of that side, both with the same object, namely, to relax tension and pressure upon the inflamed structures. There is the same tendency for the pain to shoot downwards into the thigh, and the same occasional numbness of the thigh, as in perinephritis. There is the same gradual increase of swelling, hardness, redness, and at last, perhaps, a positive tumour, sometimes apparently excited by similar causes, and often terminating in similar ways ; and whereas perinephric suppuration is prone to spread downwards into the iliac region, suppuration from appendicitis is nearly equally prone to burrow upwards into the loin. They may each give rise to œdema of the lower limb.

* *See* the author's "Surgical Diseases of the Kidney," 1885, pp. 238, 239.

The great and distinctive difference is that in perinephritis the pain, tenderness, and swelling are first and chiefly in the ilio-costal interspace behind; whereas in appendicitis they are in the iliac fossa. In both alike there may be marked constipation, or alternations of constipation and diarrhœa; but constipation is usually more obstinate in appendicitis, and may be associated with stercoral vomiting. When peritonitis is an early symptom, and comes on without collapse and before pus has had time to form in the cellular tissue, the probability is all in favour of appendicitis.

When all the symptoms are referrible to the left side, appendicitis is of course excluded; but the same inflammatory changes occur in and around the sigmoid flexure as around the cæcum, and occasionally those around the sigmoid are secondary to appendicitis. This should be borne in mind when the left side is affected.

Fœcal accumulations give rise to pain, constipation, neuralgic affections of the thigh, and hardness and swelling of the abdomen; but they are removable by aperients and enemata, are rarely associated with fever, though the temperature may rise from time to time; and are unattended by the flexion of the thigh and lateral inclination of the trunk.

Splenic and hepatic tumours, if we except abscesses, form without causing fever, and often painlessly. They have a more anterior situation and are more defined in outline, and move freely up and down in respiration. The pain, numbness, and flexion of the lower limb are wanting.

Empyema and abscess of lung will be recognisable by their usual symptoms; but when secondary to perinephritis or perinephric abscess, as they sometimes are, the flexion of the thigh and other local symptoms of inflammation of the tissue about the kidney would probably be noticeable. Dr. Bowditch gives a forcible illustration of this fact. This aid to diagnosis should always be in the mind of the surgeon, because cure may follow prompt and judicious treatment.

Typhoid fever.—The insidious onset of typhoid as of perinephritis, and the fact that occasionally both are masked by pneumonia, will show the wisdom of withholding an opinion, in certain cases, for a few days; but in typhoid there are no evidences of local inflammation, and there will soon come the

characteristic temperature and tongue, the rose spots, the tumid abdomen, the enlarged spleen, and the Widal blood reaction ; whereas in perinephritis there will be evidence of local inflammation with the absence of the above-named symptoms.

2. Having arrived at the diagnosis that the case is one of perinephric abscess, the next question which the surgeon will want to satisfy himself upon is as to whether it is *primary or secondary ; and if secondary, whether the primary affection is renal, or concerns some other organ or structure than the kidney.* In deciding this question the clinical history of the case will be all important. The history of a blow or a strain, exposure to damp or cold or to some special source of blood-poisoning, over-fatigue, the depressing influence of a continued fever such as typhoid or typhus ; together with the absence of any preceding symptoms such as would have been caused by renal calculus, renal tubercle, etc. ; and the absence of any sign of disease of the liver, spleen, colon, or cæcum, or of disease of the spine, would point to the primary nature of the abscess, and would encourage a favourable prognosis.

On the other hand, when attacks of nephritic colic, the passage of pus or blood in the urine, the development of a tumour in the flank, or the symptoms of spinal caries, of appendicitis, of caries of the ilium or sacrum, or of empyema or of any other affection which may have given rise to retro-peritoneal suppuration, have preceded the symptoms of perinephritis, then we may be fairly sure that the abscess is secondary, and the prognosis will depend upon the cause of the abscess.

The primary abscesses often commence without any definite cause, and in persons apparently in good health.

If the pus of a perinephric abscess has an odour of urine, it will not only suggest the secondary character of the abscess but it will indicate that a renal fistula communicates with the abscess. If the pus has even a strongly fæcal odour it does not necessarily indicate an intestinal origin of the abscess ; some quite simple perinephric abscesses have contained pus the stench of which is only equalled by that of ischio-rectal and various fæcal abscesses.

The escape of intestinal gas or of liquid fæces would of course point to a communication with the bowel. Such a communication is

nearly always with the colon, but occasionally with the cæcum or duodenum. Renal calculus is such a common cause of *consecutive* perinephritis that the kidney should always when possible be examined, and a calculus searched for when an abscess in the circumrenal cellular tissue has to be opened.

3. *How can the precise seat of a small abscess be localised ?* As a small abscess in the perinephric tissue sometimes causes severe symptoms, and if left unopened is prone to spread, it would be well if we could with precision exactly localise it. The following points having reference to both anterior and posterior regions, though more especially to the latter, may probably assist us in localising a small abscess with tolerable precision.

Perinephritis occurring *in the upper tracts* is likely to be complicated by pleuritic friction, pleural effusion, empyema, expectoration of pus, and dyspnœa. *In the middle tracts* the indications are suprapubic, scrotal, or vulvar pain or anæsthesia, through the ilio-hypogastric and ilio-inguinal nerve ; œdema of the scrotum, or varicocele of the left side through obstruction in the renal and thereby in the left spermatic veins ; and albuminuria and partial uræmia and suppression of urine due to renal congestion from pressure on the renal vein. Pain in the groin and scrotum with albuminuria coming on in the course of the inflammation would strongly suggest the posterior middle tract. *In the lower tract* flexion of the hip, pain, or anæsthesia of the front, inside, or outside of the thigh through the influence of the external cutaneous, anterior crural, or obturator nerves, retraction of testicle, pain at the knee, scrotal or vulvar pain without albuminuria, œdema of leg of the affected side, and pointing of an abscess in the groin, would be the signs.

In deciding upon the line of incision after making a diagnosis as to the locality of the abscess, the anatomical relations of the kidney to the surface of the trunk, as set out in Chapter I., should be borne in mind by the surgeon.

Treatment.—Primary perinephritis may be sometimes checked in its early stages by local blood-letting by means of leeches or the cupping glass, and by hot baths, and hot emollient poultices or stupes. When the acuteness of the symptoms has passed, or the inflammation is of the subacute or chronic character, absorption of the inflammatory products may follow blistering.

or hot fomentations applied over some absorbent ointment such as iodide of potassium or iodide of lead. The bowels should be well opened at the onset by a brisk purgative, and kept acting moderately by enemata or mild laxatives. Pain must be relieved by morphia in form of suppository or given by the mouth. The diet should be milk, beef-tea, or something equally simple and as readily digested. As soon as the presence of pus is suspected an exploratory incision in the loin should be made. When matter is detected it should be let out through a free opening in the loin. There should be no waiting for fluctuation ; the increasing fulness, hardness, and tenderness, and perhaps the commencing redness and œdema of the skin, are ample signs to warrant, and indeed to demand, an incision. The ancients recognised the necessity of this practice. Fabricius Hildanus knew its value, and Rayer has again and again insisted upon it. Trousseau pointed out the difficulty of detecting fluctuation, which he remarked is almost always deep, requiring great experience to detect. But the doughy feel of the lumbar region, the increase of the fever and other general symptoms, and perhaps the œdema of the skin in the loin, are indications for a free incision which the surgeon must not hesitate to act upon, and with promptitude.

The incision may be either vertical, transverse, or oblique, but preferably oblique, and after dividing the integument and muscles with the knife, the suppurating tissue should be at first entered by a puncture incision, to be afterwards enlarged. The abscess cavity should be examined with the finger and the kidney carefully palpated in search for a stone. Any loose sloughs of cellular tissue should be removed with the finger or dressing forceps. The abscess should be irrigated with a solution of iodine or carbolic solution, and a drainage tube should be inserted. The loin should then be enveloped in a large hot fomentation of cotton-wool soaked in equal parts of water and carbolic acid solution (1 in 40) ; or better still, if there is redness or œdema of the skin, equal parts of lead lotion and carbolic acid solution (1 in 40). Absolute rest in bed should be enforced throughout the convalescence.

Even when no pus exists, if the signs of acute or subacute perinephritis are accompanied by much pain, tenderness, and swelling, great benefit will accrue from the relief of tension which

the loin incision affords; and the wound should be prevented from superficially closing by the retention for some days of a drainage tube. In certain cases of early incision no pus. has been observed to escape at the time, and the surgeons have been disposed to regard the operation as a failure; but it has not been so, for in these cases immediate relief from suffering has been secured, pus has escaped within a short time after the incision was made, and the swelling in the loin has soon disappeared. All surgeons must agree (1) with Rayer, who said that when pus is accumulating around the kidney, one must hasten to let it out; " the abscess ought to be opened with the bistoury"; (2) with Trousseau, who strongly urged free incision; and (3) with Bowditch, who, in urging the advisability of an early incision, remarks, " if ever there be occasions for a *cautious boldness* on the part of the surgeon, these abscesses present them."

The published records of cases show that this teaching still needs to be enforced : and they afford an ample illustration of the fatality which attends a procrastinating or timid handling of deep-seated suppuration.

Another precaution is needed, and is suggested by some of the recorded cases. Consecutive abscesses, and also some of the less acute forms of primary abscesses which do not soften down very quickly, *must not be allowed to close too early*. On the contrary, the drainage tubes should be retained until, by the granulating process in the wound, they are forced out by degrees. If the wound is allowed to close early in these cases, fresh inflammation occurs and fresh pus is formed, which will need a second incision or run on to some fatal termination by burrow-ing far and wide. Dickinson has recorded a case in which the abscess was both opened too late and allowed to close externally too soon, so that the patient died by the bursting of the pus into the lungs.

Hæmorrhage rarely occurs when a free incision is made; and if it does the bleeding will be easily restrained by pressure or ligature. When a fistulous opening persists after the trial of suitable treatment, it should be laid freely open, the callous walls of the fistulous track should be excised and the freshened surfaces brought together by deep sutures. Should a fistula again follow this operation, then will arise the question as to

nephrectomy or ureterectomy, a point which will be fully considered in the chapters on renal and ureteral fistula, and need not be discussed here.

A lumbar hernia may follow the incision for the evacuation of an abscess, as it may one for the examination of the kidney, but this is quite exceptional. I have only once seen it result from an exploratory incision, and that was in a case of suspected renal calculus in the person of a thick-set indolent man who grew very stout.

After the incision is made, and whilst suppuration continues, nutritious food, tonics, and possibly a regulated allowance of stimulants, should be given.

Rayer * quotes a case which shows the length of time that an abscess in the circumrenal tissue, but communicating with the cavity of the kidney, may continue ; and how, when it ceases to discharge through an external opening, it may do so through the ureter and lower urinary passages.

Such a case ought to be treated by free incision in its earlier stage, and well-maintained drainage for a considerable time ; this failing, lumbar nephrectomy would, in all probability, be required to relieve the patient from periodical and dangerous feverish attacks.

The success of early incision and continued drainage has been thoroughly proved. Duffin says that in twenty out of twenty-six cases collected by him, early puncture had been made ; and of these twenty, twelve quite recovered ; in six others there was " a fair modicum of success," which means that in many cases complete success could not be expected, owing to the character of the exciting cause of the abscess. Poland † tabulated twenty-eight

* Vol. i., p. 269.

† *British and Foreign Medico-Chirurgical Review*, vol. ii., p. 235 (1871). To avoid the counting of the same cases twice over or oftener, it may be well to point out that Duffin's cases consist of Trousseau's, three of Bowditch's, and Gull's, Reed's, Quain's, Dickinson's, Hullet Browne's, Chuckerbutty's, and his own.

Poland's sources are Trousseau 16, Bowditch 10, Bryant's case, and Duffin's, and those in Duffin's collection, except Trousseau's and the cases included in Bowditch's first paper (May 4, 1868).

Nieden's list included the cases of Trousseau, Bowditch, Duffin, and numerous others.

cases of primary perinephric abscess, *i.e.* not due to pyelitis, or calculous nephritis, or to other renal causes. In fifteen of these, free incision was adopted, and recovery occurred in all but one, which succumbed to hectic fever and diarrhœa. Of eight cases not operated upon at all, six died ; in one, the abscess burst into the bladder and vagina and the patient recovered ; in the other it burst into the lung with relief. Of five cases in which the abscesses were evacuated by trocar and cannula, or by caustic potash, one died, two recovered after the evacuation of pus, and in two no pus was detected by the trocar at the time, but pus was discharged subsequently. Of ten cases of secondary abscess tabulated by Poland, the only ones which recovered were three which were operated upon ; all those not operated upon died.

CHAPTER XI.

ACUTE AND SUBACUTE PYELO-NEPHRITIS WITHOUT SUPPURATION.

ACUTE and subacute interstitial inflammation, without suppuration, may affect the whole or a part of a kidney. As a rule, both kidneys are involved, though frequently to an unequal extent.

The changes produced consist of a gradual sclerosis of the renal parenchyma, together with a thickening and desquamation of the epithelium of the renal pelvis; these changes greatly impair the resistance of the organ against the action of pathogenic microbes, so that it is very prone to suppuration should any infection reach the kidney, either through the circulation, the lymphatics, or by ascending along the ureter from the lower portions of the urinary tract. On account of this proneness to suppurate, perhaps, it is that sight is apt to be lost of the fact that pyelo-nephritis occurs without running on to the development of pus.

Etiology.—The causes of interstitial nephritis met with in surgical practice are (1) all those conditions which give rise to obstruction to the outflow of urine, whether of an acute or chronic kind, and which will be found enumerated in the chapter on Nephrectasis (p. 395), and (2) injury caused by external violence.

When interstitial nephritis and pyelo-nephritis occur as a consequence of external violence the inflammation may be either primary or secondary, that is, it may occur primarily in the kidney itself, or extend to it from the surrounding cellular tissue. When blood has been extravasated into the cavity of the kidney, and the urine is retained there because of the impaction of a blood-clot in the ureter, pyelitis and pyelo-nephritis may arise as in any other case of obstruction to the outflow of urine.

It is seldom, if ever, that the pelvis of the kidney alone is inflamed as a result of injury. Almost invariably when pyelitis occurs there is also interstitial inflammation of the kidney substance. On the other hand, interstitial nephritis, either of an acute or chronic character, may occur without any of those

indications in the urine which point to inflammation of the pelvis of the kidney.

The onset may be very insidious, and the condition may remain undiagnosed until attention is drawn to it by an acute exacerbation of pain or some other prominent symptom. Thus, not unfrequently the onset is dated from the passage of a catheter, but whether this ever actually gives rise to the condition is difficult to say. In most cases the probability is that the passage of an instrument intensifies a previously existing nephritis, either reflexly or by causing an acute congestion, as sometimes occurs after rapidly relieving a long-standing retention in cases of enlarged prostate. Or the instrument may serve as a carrier of micro-organisms; and the absorption of some septic material through an abrasion may rapidly make itself felt on the already diseased kidneys.

Drugs.—Inflammation of the renal substance and the pelvis is excited by large doses of certain drugs, such as cantharides, turpentine, and other diuretic irritants.

The action of these drugs is chiefly upon the tubules of the kidney, and therefore, strictly speaking, their effects do not come under the headings of this chapter which treats of interstitial not tubular nephritis.

It has, however, been thought advisable to refer to them here at some length, not only on account of the pyelitis they produce, which comes under this section, but also by reason of the fact that the acute changes in the tubules of the kidney may be followed later by more chronic interstitial changes, and because the injury to the kidneys produced by these drugs lowers their resisting power very greatly and predisposes them to ascending or descending infections. It will therefore be seen that these drugs must be given with the greatest care to persons who are suffering from any disease of the genito-urinary track.

Robin has studied these inflammatory changes and has described a catarrhal and a fibrinous variety. The catarrhal inflammation follows the elimination of turpentine, copaiba and other drugs, and is characterised by renal pain, highly coloured urine which may contain albumen, and a frequent desire to micturate; all these symptoms usually rapidly disappear when the drug is withdrawn. The fibrinous variety follows large doses of cantharides and has been experimentally studied in animals.

The lesions in the kidneys are diffuse and are characterised by swelling and desquamation of the epithelium of the convoluted tubules, followed later by exudation of leucocytes into the interstitial tissue. There is congestion of the mucous membrane of the pelvis, accompanied sometimes by the formation of a membranous exudation.

I have the notes of one case in which the renal pelves of a man, aged twenty-nine years, who died from oxalic-acid poisoning, were most acutely inflamed and the seat of numerous ecchymoses.

It is not, however, probable that these drugs are ever the direct cause of suppuration, for in most of them the chief seat of disturbance is the bladder or prostate; still the conditions they give rise to in the kidney are those which favour an infection, if such be in any way introduced into the system, either locally through the bladder or generally through the circulation.

Irritant drugs, such as cantharides and turpentine, have been supposed however to cause renal abscess. In the College of Surgeons museum is a kidney in which pus was extensively diffused through the cortical substance, and between it and the capsule. This kidney was removed from the body of a man aged sixty, to whom tincture of cantharides had been administered for incontinence of urine following retention.

Symptoms.—(1) The mode of onset of the first form of interstitial nephritis varies with the cause. The more chronic forms, which arise during long-continued obstruction to the flow of urine, are usually very insidious in their onset. There is often no rigor, and frequently not even a chill to mark the time of their commencement, and they run a very irregular course, extending sometimes over many weeks or months, during which there may be intervals of considerable improvement which give rise to the idea that recovery has taken place. The more acute cases, which frequently follow upon a chronic condition, are accompanied by a rigor or a succession of severe chills, which may be continued at intervals until the attack has subsided.

As soon as the inflammation has thoroughly set in the general health of the patient is much impaired. This is shown by weakness, languor, drowsiness, loss of appetite, flatulence, and often by a feeling of extreme flatulent distension of the abdomen,

rapid emaciation, pinched features, and a dull, leaden, or sallow complexion.

The temperature in the morning is normal or sub-normal, but rises at night to 100°, 101°, or 102° Fahr.; and thus it may continue for days or weeks together; or there may be intervals during which the morning temperature is one or two degrees above normal, and the evening temperature one or two degrees above the morning; or, again, periods may occur during which the evening temperature does not reach above normal, and the morning temperature remains normal or slightly sub-normal. As a consequence of the difference in the constitutional states suggested by the temperature, the patient feels better in the morning and also during the periods of normal night temperature; his skin is cool and he is free from thirst. As the day wears on, and when the intervals of normal evening temperature have passed, languor and drowsiness overtake him, his skin is hot and pungent, and there is great thirst, with marked disinclination for, and even loathing of, food. Sometimes profuse sweats break out all over the body, and occasionally are frequent and severe enough to require a change of linen three or four times in the twenty-four hours. The tongue is sometimes but little altered, being moist and only slightly furred; but in most cases it is dry or coated with a dirty white fur. Nausea is often complained of; sometimes actual vomiting is present, but this is not the rule. The bowels may act regularly, or may be constipated or relaxed; usually there is but little deviation from the habitual state.

Rarely, if ever, is there any tenderness on deep pressure about the kidney, and pain is seldom felt; though in some cases there is muscular aching, described variously as lumbago, rheumatic pains in the limbs, or a feeling of soreness, as of having been " beaten all over with a stick." Generally, however, there is freedom from pain, unless it be caused by the primary disease; and the patient is either in a state of drowsy languor, or when for the time free from fever he expresses himself as comfortable and doing well.

But little information is to be gleaned from the urine, though it should always be most carefully and repeatedly examined. Too often, especially when the renal inflammation is the result of

obstruction, pus, mucus, and even blood derived from the in-
flamed mucous membrane of the pelvis mask the characters
possessed by the urine as secreted. In other cases of obstruction,
where no cystitis is present, the urine is of lower specific gravity,
and more abundant in quantity than normal, but this is owing
probably more to the chronic pressure changes in the kidney
than to the nephritis. In other cases, again, and more especially
where the nephritis has not been preceded by chronic renal changes,
there is nothing abnormal either in the character or quantity
of the urine.

There is never more than a trace of albumen in the urine
as it is secreted, but when cystitis, prostatitis, or urethritis exists,
there may be a considerable admixture of pus or blood. Under
such circumstances, in order to ascertain the real nature of the
urine, the bladder and urethra should be well washed out, and
the urine which is secreted immediately afterwards should be
drawn off through a clean catheter, tied in the bladder for a
quarter or half an hour. In all probability this urine will be
acid and free from pus and blood.

When the disease is going to terminate favourably, the symp-
toms just described gradually disappear; the patient feels less
drowsy and stronger, his appetite returns, flatulence ceases, the
temperature becomes and continues normal, and thus by degrees,
and sometimes very quickly, he returns to thorough health. In
some cases, however, this apparent recovery is delusive, and after
a longer or shorter time all the same symptoms recur; the
improvement and subsequent relapse being generally caused by
a corresponding improvement in, and aggravation of, the original
disease; or, in other cases, the relapse is excited by a fresh
instrumental disturbance of the urinary passages. When the
nephritis does not terminate favourably, the above symptoms
either exist for a long time, while the patient grows weaker
and weaker, until at length he dies of sheer exhaustion; or,
what is more frequent, suppuration of the kidney, to be described
in the next chapter, supervenes, and rapidly carries off the patient,
who becomes first more or less delirious and then comatose.
Patients occasionally die who have had all the symptoms of sup-
purative pyelo-nephritis; and yet on post-mortem examination
the kidneys to the naked eye are merely small, tough, and

granular, but on microscopic examination marked interstitial inflammation and, perhaps, foci of commencing suppuration, are found.

Symptoms.—(2) The onset of *traumatic nephritis* is nearly always announced by a rigor ; then follow thirst, dry tongue, heat of surface, restlessness, and all the other symptoms which characterise the febrile state. The initial rigor may be severe or slight, but it is rarely wanting altogether. Pain in the renal region is not constant in character, and is very variable in degree. That which was due to the original violence may have entirely ceased under rest and treatment ; and then, after some days of ease, fresh suffering, often more intense than the first, is felt in the neighbourhood of the kidney. This pain is commonly felt over the affected side only, but it may involve both, though the injured side more severely.

It is deep-seated, referred to the loin rather than to the front of the kidney ; is sometimes circumscribed and limited to a point in the flank, at others diffused over the whole flank, or even extending along the course of the ureter, to the groin or testicle. Sometimes the pain is widely diffused over the lumbar, hypochondriac, and central areas of the abdomen, even in cases in which no perinephritis exists. It may be acute, and increased on the slightest pressure ; or of a dull aching character, scarcely, if at all, aggravated by pressure ; or so slight and obscure that only firm pressure, first over one loin and then over the other, brings out the fact that one side is tender and the other not. The pain is seldom of the same intensity throughout, exacerbations and remissions being the rule. It is rarely of a throbbing or plunging character, except when the perinephric tissue is also inflamed. Sneezing, coughing, lying on the affected side, bending the trunk forwards, and nearly all movements of the body, aggravate the pain, and this is more especially the case when perinephritis or peritonitis complicates the nephritis.

Though traumatic nephritis usually involves one kidney only, yet either as the effect of the inflammation of the injured organ, or in consequence of the fever which the nephritis causes, it is not very unusual to find, after an injury to one kidney, that the amount of urine is greatly diminished or altogether suppressed for a time.

If the disease sets in shortly after the receipt of the injury, the urine always contains a trace of blood, sufficient sometimes to give it a brownish or red tint. When the blood ceases, the urine, though it looks natural, still continues to be albuminous for a time. Later on, pus in small quantity may be found in the urine, but this is not usually the case; and when it is found its presence indicates that the suppurating area of the renal substance communicates with the cavity of the kidney, or, what is comparatively more probable and frequent, that the mucous membrane of the pelvis and calyces of the kidney is involved in the inflammatory process. In many cases in which, at the inspection after death, suppurating foci are found in the cortical and medullary parts of the kidney, the urine during life was free from pus. The presence of pus, therefore, means pyelitis as well as nephritis, or else that an abscess formed in the renal substance has broken into the pelvis or into a calyx of the kidney.

The reaction of the urine in nephritis, uncomplicated with disease of the lower urinary track, is acid; or it may be neutral from excess of blood or pus.

The cessation of the pain in the loins, and of the feverish symptoms, and the return of the urine to its natural quality and quantity, indicate the termination of the inflammation by resolution. The persistence of pain and fever, the irregular occurrence of rigors and elevations of temperature, the frequency and smallness of the pulse, the sallow skin, emaciation, vomiting, the development of cerebral or typhoid symptoms, point to the termination by suppuration in the kidney substance. The presence of pus in the urine does not necessarily mean that the inflammation of the kidney substance has gone on to suppuration; in the large majority of cases it signifies only that pyelitis has been engrafted upon a non-suppurative interstitial inflammation.

When perinephritis follows an injury to the loin and is itself followed by nephritis, it is generally very difficult, if not quite impossible, to be sure as to the time at which the inflammation reached the kidney. Sometimes, but by no means always, the commencement of the nephritis is marked by a decided diminution in the amount of urine excreted.

When perinephritis terminates in perinephric abscess, it is

often not clear whether the kidney is or is not involved, though it is easy to diagnose the extrarenal abscess by the swelling, and œdema, and throbbing pain in the loin.

An occasional result of injury to the loin or kidney is the discharge of a quantity of red sandy deposit in the urine. This has long been known and described as one of the consequences of an accident involving the renal region. M. Verneuil in 1885 drew attention to the fact that the urine of patients who have sustained injuries to or undergone surgical operations upon other parts of the body, sometimes exhibits a rose-coloured deposit of a peculiar material easily recognisable with the naked eye as it adheres to the urine glass. It is a transient condition, lasting only two or three days, and comes on soon after the injury. These deposits indicate, so M. Verneuil considers, a tendency to secondary hæmorrhage and gangrene after injuries. The nature of the pigment has not been ascertained, but its origin has been supposed to be in some way related to hepatic disease. It does not seem to be a consequence of traumatic nephritis.

Cæsar Hawkins † reported a case of a man, aged forty-six, who on January 26th, 1829, fell from a height and severely injured both loins. Three days afterwards he had pain in the right renal region extending to the groin, and pain on micturition ; in his urine, which was excreted in ordinary quantities, there was a red sand which made the urine turbid, and became deposited on the sides of the urine bottle.

Diagnosis.—When a patient is suffering from cystitis, whether due to stricture, stone, prostatic enlargement, cancer, or other cause ; or when a surgical operation has been performed for stone, bladder tumour, stricture, urinary fistula, urinary abscess, or extravasation, it is often impossible to decide as to how far the symptoms are caused by the primary disease or to superinduced interstitial nephritis. Under any of these conditions, chronic blood poisoning, due to the absorption of decomposing urine or pus, may arise, and excite much the same symptoms as subacute interstitial nephritis ; whilst the acute form of the disease, even when no suppuration exists, may possibly be mistaken for pyæmia, septicæmia, typhoid fever, or septic peritonitis.

* *La France Médicale*, Mai 2, 1885.
† *Lon. Med. Gazette*, vol. iii., p. 399, 1829.

When the symptoms above described come on shortly after passing an instrument along the urethra, or after the performance of some surgical operation, there ought to be little doubt as to their cause, and active renal inflammation should be diagnosed. In cases of urinary obstruction, interstitial nephritis ought to be suspected when loss of appetite, elevation of evening temperature, lassitude, thirst, dry tongue, flatulence, and nausea, are accompanied and followed by progressive emaciation. If, in addition, there be occasional chills and profuse perspirations, the diagnosis is made fairly clear ; and if with these other symptoms the urine is over-abundant in quantity, of low specific gravity, and with very little or no albumen, it may be looked upon as certain.

A due appreciation of the above symptoms, with a close inquiry into the clinical history of the case, and the antecedent condition of the patient, ought to point to the exclusion of pyæmia, septi-cæmia, typhoid fever, and septic peritonitis.

Prognosis.—If the primary cause of disease is removable, recovery may be hoped for, and in a large proportion of cases will be realised. If the cause of obstruction cannot be removed, or, after being removed, leaves behind so severe a condition of bladder or prostate that the urine continues to decompose as soon as it reaches the bladder, suppuration in the kidney will in all probability supervene, and a fatal termination will certainly occur. Death may ensue before the disease has passed into the suppurative stage.

In cases in which the onset of the nephritis is associated with prolonged suppression of urine, great danger exists, and a fatal termination should be apprehended. It was said by Beck that suppression, if lasting over one day, is almost always fatal. I have, however, seen recovery in one case after suppression for fifty-two hours, and in others, after suppression for thirty-six and forty-two hours.

As a rule, traumatic nephritis is not fatal, and often not even serious in its course or consequences, provided that the damage inflicted on the kidneys by the injury is not great, and that the large vessels are not ruptured. The inflammation, under these circumstances, yields readily to treatment, and the duration of the attack is completed in from ten days to a fortnight. The prognosis in nephritis which is the result of

obstruction depends largely upon the cause of the obstruction, and as to whether it is removable or not, and upon the stage which the inflammation has reached. When the cause is removable and the nephritis not greatly advanced, complete recovery may be expected.

Pathology.—Both kidneys are almost invariably affected in the non-traumatic form. Their appearance varies considerably with the stage of the disease; in recent cases they will be found somewhat increased in size, while in the later stages they will be found diminished and misshapen owing to the contraction of the recently formed connective tissue.

The capsule is thickened, and vascular, and is as a rule somewhat adherent to the renal tissue, leaving a roughened granular surface when stripped off. There is often also an excess of perinephric fat, which is closely adherent to the renal capsule and grows into the kidney itself at the hilum.

On section the kidney surface bulges, owing to the amount of intertubular exudation, and it often presents a pale or mottled aspect, like the uncut surface of the organ. The aspect of the pyramids varies: sometimes they are of a deep red colour, contrasting markedly with the pale cortex, while at other times they are pale; but they usually preserve their conical form in spite of dilatation of the pelvis, which often exists when there is obstruction to the urine below. Sometimes again, yellowish streaks pass through them parallel with the tubules.

The pelvis of the kidney sometimes appears quite normal, though there is usually some degree of dilatation present; at other times it is deeply congested and ecchymosed, or coated with a layer of false membrane; at others again it is acutely inflamed.

The condition of the urine also is naturally very various; it may be quite normal and acid, or alkaline, purulent, and decomposing.

The ureter, like the renal pelvis, presents different appearances according to the duration of the disease. In long-standing cases it is dilated and its walls are thickened and sometimes thrown into folds which, acting as valves, tend further to obstruct the outflow of urine.

Microscopically the principal alteration seen is an increase of connective tissue; this affects almost simultaneously the medulla

and the cortex. The distribution of the connective tissue is irregular, and different areas of the kidney may be very unequally affected, so that a true hypertrophy of some parts and considerable disease of the remainder are very possibly present in the same organ.

The tubules and vessels are pressed upon, and the former are distorted, being constricted in some parts and dilated in others. The tubular epithelium may be granular and swollen, and is often easily detached from its membrana propria.

The microscopic characters were closely studied by Beck, who pointed out that the anæmic condition of the cortex, as often seen after death, is no evidence that during life it was in the same condition; but that as the kidney, owing to the amount of exudation, is tightly compressed within its capsule, the vessels are emptied as soon as the heart ceases to beat.

In cases arising from acute retention of urine the changes are characterised by marked congestion, sometimes accompanied by actual hæmorrhages into the kidney substance. There is also some desquamation of the epithelium of the tubules, and an increase in the entire volume of the kidney, varying, of course, with the intensity and duration of the attack. The secretion of urine under these circumstances is much diminished and poorer in salts than usual, while it often contains albumen, blood, and epithelial casts. After the retention has been relieved there is often polyuria, and the kidney gradually returns to its normal condition.

An important fact connected with traumatic nephritis is the disposition to the formation of renal calculus and gravel; this explains the occasional occurrence of renal colic after wounds, concussion, or severe shakings of the kidney. A clot of blood, derived from traumatic hæmorrhage into the renal pelvis, has not unfrequently formed the nucleus of a renal calculus; but there is no doubt at all that acute and chronic inflammation of one of the kidneys, quite apart from the presence of blood-clots in its pelvis, has been an occasional cause of urinary concretions.

Cicatricial kidney.—When recovery occurs after acute interstitial nephritis, the kidney is granular and contracted, and often deeply and broadly scarred and puckered. This is the condition which has been called the " cicatricial kidney "

(Marcus Beck), and is the result of an intertubular exudation of inflammatory material, followed by its contraction. Sometimes this state is associated with the wasting and distension of the kidney, which are brought about by urinary obstruction. There is good ground for believing that under favourable conditions, and especially after the amelioration or removal of the exciting cause, even small abscesses may be recovered from, the abscesses disappearing and leaving small scars or cicatrices in the renal tissue.

Moxon's researches * point to this as a termination of disseminated abscesses of the kidney without very marked destruction of the renal tissue.

Treatment.—In no disease is the old adage, " Prevention is better than cure," more true than in these secondary affections of the kidney. Prevention, too, is all the more desirable because our means of cure are uncertain, and for the most part quite inefficient.

As steps towards the prevention of nephritis, it cannot be too forcibly stated :

(1) That the causes of obstruction to the passage of urine should as soon as possible be overcome, and retention, or partial retention, obviated by the catheter. Stricture must be dilated or divided ; perinæal abscesses opened ; the condition of the prostate should be ascertained, and when found to be enlarged, the patient should at once be taught the use of the catheter ; vesical calculi should be crushed or removed by lithotomy, though it must be understood that the rapid method of lithotrity has now done away with the need of replacing lithotrity by the more dangerous operation of lithotomy in cases in which renal disease complicates vesical calculus.

(2) That all instrumentation should be as gentle and as limited as the requirements of the particular case will allow, so as to avoid the risk of reflex irritation of the kidney.

(3) That decomposition of the urine within the bladder should be prevented or checked by the evening and morning irrigation of the bladder with some antiseptic wash. A solution of salicylate of soda (five grains to the ℥j), of quinine (one grain to the ℥j), of acetate of lead (one grain to ℥iv), of borax (five grains

---

* " On Recovery from Surgical Suppuration of the Kidney," *Path. Soc. Trans.*, vol. xxiii.

to ℥j), of warm water coloured pink with Condy's fluid, or containing a trace of carbolic acid, or of thymol and glycerine (in the proportion of one part of thymol in seven of glycerine), may be used for this purpose. The fluid should be introduced through as large a catheter as can be comfortably passed, and the catheter should have two large well-formed eyes. Not more than ℥iij to ℥iv of the solution should be thrown in at a time ; then this should be allowed to run out, and the same process should be repeated four or five times, or more, at a sitting.

In any case in which subacute or acute renal mischief is anticipated, and certainly from the outset of its existence, the patient must be confined to his room, and, as a rule, absolutely to his bed ; his skin should be kept thoroughly warm, and free from the risk of chills or the effects of changes of temperature ; all exertion should be avoided from the first ; the bowels should be acted upon daily by enemata ; hot baths or wet packing or vapour baths should be employed if they can be borne ; hot dry bran or flannels should be applied to the loins, and dry or moist cupping in the same region should be resorted to, especially if there is pain or tenderness about the kidneys. The food should be of a bland, nutritious, and easily digested character ; stimulants, as a rule, should not be allowed, or, if allowed at all, only in small quantity, and in as pure a form as possible ; but if patients, who have always drunk freely, are in a very weak condition, and cannot take sufficient food, then a moderate measured quantity of some pure wine or spirit will be needful.

No medicines are of any special use ; still, I have seen marked benefit in cases uncomplicated by pre-existing chronic renal disease, but attended with suppression of urine, from the hypodermic injection of one-eighth to one-fourth of a grain of morphia with one hundred and twentieth to one-eightieth grain of atropine. Tannic acid in two-grain doses, given every three or four hours, has been recommended especially in cases of abundant mucus secretion in the urinary passages (Ebstein). Quinine in grain and a half or two-grain doses, with citrate of potash (twenty grains) and mucilage ℥j, together with a little opium (five to ten min.) is often beneficial. If the temperature is rising, a dose of five to ten grains of quinine with lemon-juice ℥j, and vin. opii ℥ss, is sometimes of much value.

Opium by some surgeons is considered the most useful of drugs, because by increasing the action of the skin it tends to relieve the congestion of the kidneys ; but it is a remedy which ought to be given with great caution, for it must be remembered that symptoms much resembling, sometimes actually expressive of, uræmia occur in acute interstitial nephritis.

When acute or subacute interstitial nephritis has been preceded by intrarenal tension and chronic interstitial inflammation, the amount of urine secreted is very large indeed ; and under these circumstances I have seen good results follow the administration of the liquid extract of ergot given in ʒss doses every three or four hours for thirty-six or forty-eight hours.

Surgical operations, and more especially operations upon the urinary organs, if it be possible to postpone them, should never be undertaken during the existence of acute or subacute interstitial nephritis, or of any of the forms of " congestive " urinary fever.

CHAPTER XII.

SUPPURATION OF THE KIDNEY.

THE kidney, or its pelvis, may become infected by septic organisms in various ways:—

1. The micro-organisms may reach the kidneys through the circulation and, lodging in the capillaries, give rise to numerous small suppurating foci ; or one or more larger infective emboli may occur, as in cases where a particle of an infected cardiac valve becomes detached, and, lodging in the kidney, gives rise to a septic infarction followed by an abscess.

In both these conditions the infective process usually commences in the kidney substance, to which it may be entirely confined ; but in many cases it spreads into the pelvis, and thence into the ureter, and gives rise to a *descending* pyelonephritis.

2. The kidney may become infected from some septic condition situated in the lower parts of the genito-urinary tract, such as, for instance, cystitis, which is one of the most frequent causes. In these cases the micro-organisms either ascend to the kidney by a process of continuity along the mucous membrane of the ureter, or they are conveyed by the lymphatics in the ureteral wall. The renal pelvis will thus, in most cases, become infected before the kidney substance, and the condition is then spoken of as an *ascending pyelo-nephritis*, in contradistinction to the condition already described, in which the pelvis is affected secondarily to the kidney.

3. Occasionally the kidney becomes invaded through the direct spread of suppuration from neighbouring organs, but, owing to the anatomical position of the kidneys and their protection by thick capsules, this mode of infection is not common.

4. Lastly, it must be remembered that two or more of the above conditions can co-exist. For instance, an ascending pyelo-nephritis may be progressing at the same time that infective micro-organisms are reaching the kidney through the circulation.

The varieties of suppurative affections of the kidney may be classified as—

A. *Diffuse Suppuration.*

B. *Circumscribed Suppuration, i.e.* Abscess.

The former class—*Diffuse Suppuration*—may be sub-divided thus :—

1. Suppurative nephritis, due to infection through the circulation.

2. Suppurative nephritis ascending in origin.

3. Suppurative pyelitis, either primary, or ascending in origin.

4. Suppurative pyelo-nephritis, either primarily renal, or of ascending origin.

5. Pyo-nephrosis, *i.e.* suppuration of a dilated kidney. This form of suppuration is dealt with in the chapter on Nephrectasis (*see* p. 444).

Suppurative nephritis, or, in other words, " acute interstitial nephritis, with scattered points of suppuration " (Beck), occasionally occurs alone, without any affection of the ureter and pelvis of the kidney ; this, however, is not the common case. Usually acute pyelitis and suppurative nephritis exist simultaneously. If suppurative nephritis happens to be uncomplicated by pyelitis, the nephritis is prone to be clinically overlooked, because the urine contained in the pelvis of the kidney, and passed off through a catheter immediately after washing out the bladder, is acid and without the odour of decomposition. Nevertheless the temperature and other constitutional symptoms ought to prevent this mistake. An important distinction consists in the presence or absence of distension of the renal pelvis.

Pyelo-nephritis without distension shows itself by high temperature and other symptoms, and admits of medicinal treatment ; pyelo-nephritis with distension usually manifests itself by the presence of an abdominal tumour and other definite signs, and generally speaking needs surgical methods.

Bacteriology.—The variety of micro-organisms in any given case of suppuration of the kidney or its pelvis naturally depends upon the source of the infection. But while it is possible that any pyogenic organisms may be present, it is found, as a matter of fact, that the bacillus coli is by far the most common, the infection by this organism in most of the cases probably

arising from the intestine. The bacillus coli communis can escape from the intestine under a variety of circumstances, and may reach the kidney in its wanderings; whether it infects the organ or not depends upon the virulence of the bacillus and the local resisting power of the kidney. A kidney, weakened by injury or previous disease, is always more liable to infection than one which is healthy; and the virulence of the bacillus coli, as in the case of many other organisms, is known to be capable of undergoing considerable variations.

Under these circumstances, it is not difficult to understand that in many cases the kidneys may be able to excrete the bacteria without injury, while in others the organisms find a suitable soil upon which to grow.

Streptococci and staphylococci are not unfrequently present, especially in the ascending varieties of pyelo-nephritis; and in many instances there is a mixed infection.

The exact relative importance of these different organisms in suppurative diseases of the kidney is not at present fully known.

Guyon, Albarran, Hallé, and others consider that in the majority of cases the bacillus coli plays the principal part. Rovsing, on the other hand, believes the bacillus coli to be less injurious than the staphylococci and streptococci, on account of its feebler power to decompose urine. Rovsing also considers that the ability of the coli bacillus to attack normal mucous membrane of any part of the genito-urinary tract to be very slight; and in proof of this he cites twenty-nine cases of coli pyelitis, which he had observed, in which the bladder remained normal though it had in some cases been for years the reservoir of very purulent urine swarming with coli bacilli. In all such cases Rovsing considers that the coli infection was secondary to some slight injury to the renal pelvis, such as might be produced by a calculus, or in a floating kidney which had undergone a sudden swelling or become incarcerated.

Whatever be the relative importance of these several organisms, there seems but little doubt that the bacillus coli is the one most frequently present, and most observers in this country are inclined to ascribe the chief importance to it. It must, however, be remembered that its frequent predominance does not necessarily bear any direct relation to its virulence,

and it is probable that some of the most severe cases of suppuration of the genito-urinary tract are the result of a mixed infection. The diplococcus pneumoniæ, the bacillus lactis ærogenes, the bacillus pyocyaneus are all recorded as having been found on various occasions, and in one case Bockhart claims to have found the gonococcus,* and Gerster and Bransford Lewis have found it in others (see post, p. 450).

A large number of the suppurative cases are due to secondary infections, and the organism of the primary infection may exist alongside that of the secondary, as so often is the case in the tuberculous kidney.

A. DIFFUSE SUPPURATION.

VARIETIES : (1 AND 2) SUPPURATIVE NEPHRITIS, (3) SUPPURATIVE PYELITIS, (4) SUPPURATIVE PYELO-NEPHRITIS.

Either suppurative nephritis or suppurative pyelitis may occur separately, but much more frequently they occur together.

Suppurative nephritis is the most common, but not the only, fatal form of kidney affection consecutive to disease lower down in the urinary passages. Acute interstitial nephritis without suppuration sometimes ends fatally. Nor is suppurative nephritis invariably associated with suppuration in the pelvis of the kidney, *i.e.* with pyelitis ; but so generally do the two conditions co-exist that the terms suppurative nephritis and suppurative pyelo-nephritis, as ordinarily used, are well-nigh synonymous. It occurs in the dilated and sacculated as well as in the undilated kidney ; and in a number of cases pyelo-nephritis and pyo-nephrosis co-exist.

Suppuration of the ureter, of the renal pelvis, and of the kidney substance are some of the commonest sequelæ of obstruction of the urinary passages associated with decomposition of the urine ; and it is to these cases that the term " surgical kidney " has been so inaptly applied.

In the large majority of the cases suppurative pyelo-nephritis is ascending in character, but in others the infection reaches the kidney through the circulation, and in these the suppuration begins in the kidney and then later on descends to the pelvis and ureter.

---

* It may be mentioned in this connection that in the pus from an abscess of the testicle of a patient not long since under my care, Mr. Foulerton found the gonococcus. The man most positively denied ever having had gonorrhœa, and had certainly no signs of it at the time.

Occasionally several areas of suppuration coalesce and form an abscess of large size, which may burst into the surrounding tissue or into the pelvis of the kidney, but these cases have been fully considered in dealing with renal abscesses (Chapter X.).

An ascending suppurative pyelo-nephritis is in most cases preceded by dilatation of the pelvis and calyces, and this is also of clinical importance, since any considerable dilatation of the pelvis will often give rise to a definite tumour, which can easily be recognised on careful palpation.

Causes.—*Obstruction to the flow of urine.* — The principal causes which give rise to suppurative pyelo-nephritis are those which

Dilatation and ulceration of urethra behind second stricture.

¹/₅

Tight stricture 3 inches from external meatus.

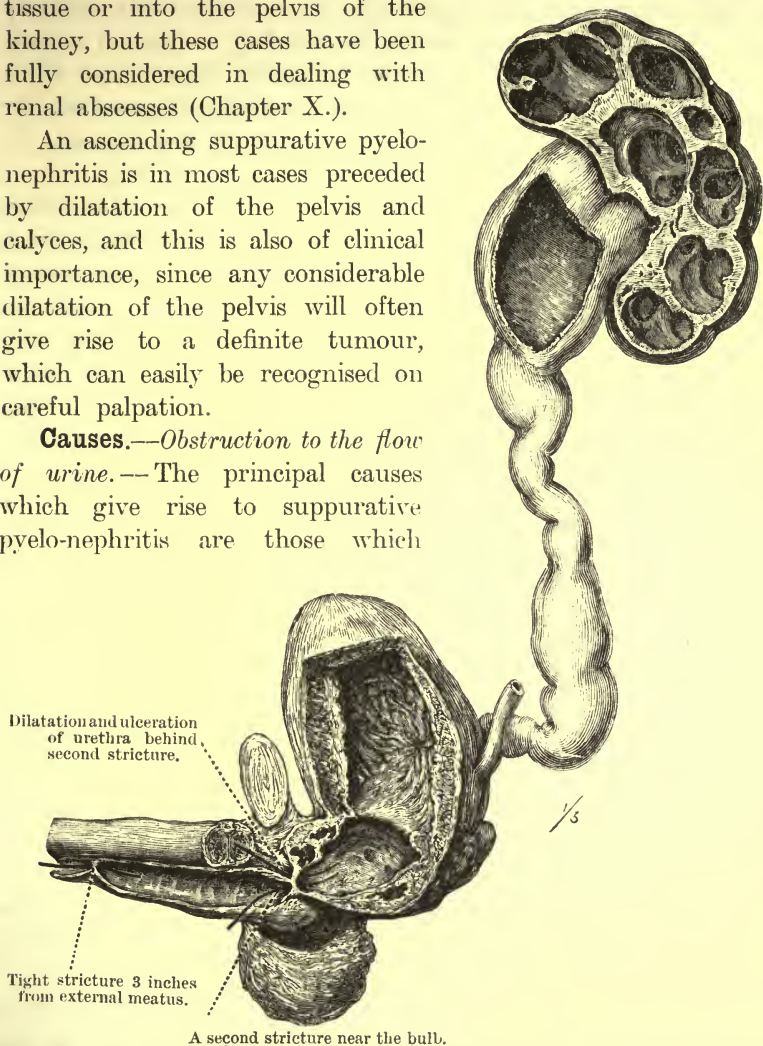A second stricture near the bulb.

Fig. 36.—Dilatation Effects of Stricture on Ureter and Kidney, with absorption of kidney substance. From a young man who died from extravasation of urine and gangrene of the scrotum. (Middlesex Hospital Museum.)

retard or prevent the outflow of urine, such as enlargement of the prostate, stricture of the urethra (Fig. 36), vesical calculus especially when of large size, atony or paralysis of the bladder

VCL. I.—V

such as occurs in many diseases and injuries of the spinal cord ; congenital phimosis, foreign bodies or new growths—such as calculi, blood-clots, parasites, and cancer—in the ureter, renal pelvis or calyces.   In the female, pregnancy, affections of the sexual organs, such as perimetritis, ovarian disease, malignant disease, and pelvic inflammations, may each cause secondary nephritis by encroaching upon the bladder or lower end of the ureters and causing obstruction to the outflow of urine.

According to Navas, a slight amount of pyelo-nephritis during the course of pregnancy is not an uncommon occurrence, and is due to the pressure of the gravid uterus upon the ureters causing retention and congestion of the kidneys, which may easily be followed by infection ; the usual microbe being the bacillus coli, which is especially predisposed to activity by the constipation which usually accompanies pregnancy.   There is nothing special regarding the symptoms of these cases as compared with those arising from other causes, but Navas considers they are often thought to be due to cystitis.   The prognosis would seem to be sufficiently grave : out of eleven cases quoted by Navas, two died after delivery, and in two others abortion occurred ; a good recovery is usually made after delivery has been effected.

Chamberlain also has at some length discussed the close relationship between pregnancy and pyelo-nephritis, and he points out that while the kidney becomes congested by pressure upon the renal veins, the bladder is also liable to cystitis owing to the pressure exerted upon it, and to the hindrance which is often caused to the free outflow of urine; and thus the kidney is rendered more liable to any infection through both these conditions.

Suppurative pyelo-nephritis may also occur from the decomposition of the urine arising out of any case of neglected cystitis, whether due to obstruction or not.

Guyon has shown that general arterio-sclerosis also is an important predisposing cause, for it not only gives rise to alterations in the prostate which eventually lead to urinary obstruction, but it also produces chronic interstitial changes in the kidneys which considerably lower their powers of resisting infection ; long-continued hyperæmia or congestion also acts as a predisposing cause in the same way.

The mechanism of obstruction in cases arising from this class of causes is as follows : —

The outflow of urine from the bladder becomes obstructed either through enlargement of the prostate, stricture of the urethra, or some other cause, and retention is the result. If the retention is acute it will shortly be followed by a congestion of the kidneys and their pelves, varying in intensity according to the duration and intensity of the retention. If, on the other hand, the condition is a chronic one, the changes are much more slowly produced. The bladder gradually undergoes alterations in its size and in the structure of its walls ; the ureter dilates, its mucous membrane is congested and its walls are thickened, and later on the pelvis and calyces undergo analogous changes : finally the kidney itself is affected, its canaliculi are dilated, and a gradual slight sclerosis takes place throughout the organ. During these stages, called by Albarran the " aseptic period," the kidney and its pelvis are still free from infection, but their resisting power is greatly lowered, and they easily succumb to any organisms which may reach them.

The next stage is the period of infection, and is characterised by a septic condition of the urine in the bladder, either through the frequent passage of instruments or some other cause.

The inflammation which results gradually spreads from the bladder to the ureters and pelves, and finally gives rise to typical suppurative pyelo-nephritis. If the stagnant urine in the bladder is albuminous, the condition becomes still more favourable for the growth of bacteria, and the disease then spreads more rapidly.

In Fig. 37 is shown a well-marked suppuration of the kidney with a dilated pelvis which had occurred as the result of cystitis in a man, aged fifty-three. The surface of the kidney was irregular and numerous small suppurating foci projected from it. In addition to these foci, there was on the anterior surface a dark globular mass (shown in section in the figure) in which there were no signs of suppuration, but which was filled with blood-clot, and was evidently a hæmatoma, a condition of things which is very rarely found in cases of this description.

General infections.—Suppurative pyelo-nephritis may occur during the course of diphtheria, typhoid, typhus, and other exanthemata, and the general constitutional disturbance accom-

panying these conditions renders the kidneys very prone to infection through catheterisation. I have known acute suppurative nephritis to occur in a young woman suffering from typhoid fever who had been daily catheterised for twenty-five days before death. It also occurs as a result of general pyæmic conditions, and it is by no means an uncommon complication in

Section of a
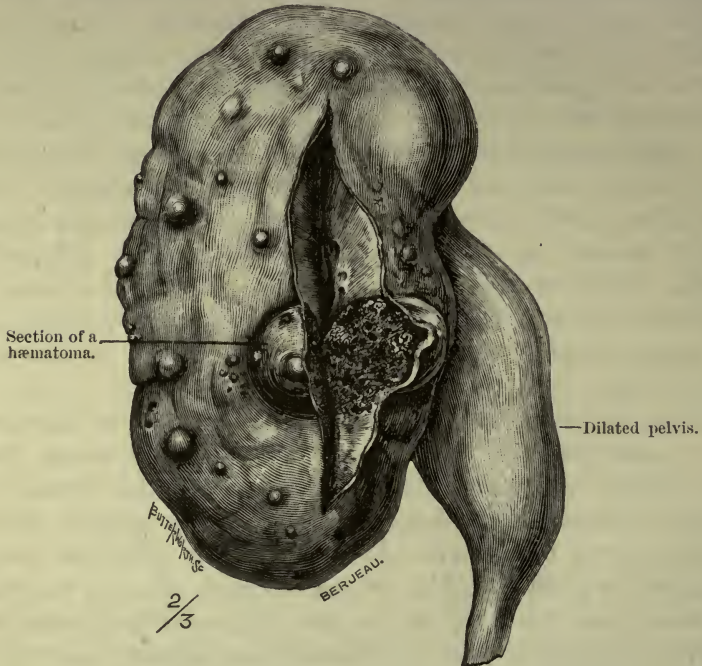hæmatoma.

Dilated pelvis.

$\frac{2}{3}$

BERJEAU.

Fig. 37.—Suppurative Pyelo-nephritis of right Kidney and a Hæmatoma in the Parenchyma consecutive to Cystitis. (Middlesex Hospital.)

cases of general infection arising from erysipelas, carbuncles, and osteomyelitis ; in the last named disease it is especially common, and Lannelongue found abscesses in ·the kidneys in seven out of ten fatal cases. It is likewise very frequent in infective endocarditis, the infection reaching the kidneys through the emboli arising from the diseased cardiac valves. It may also occur as a complication of other general diseases, such as acute and chronic Bright's disease, scurvy, cholera, and diabetes; being induced by the alteration in the characters of the urine secreted under the influence of severe constitutional disorder. Or it may be due to

changes in the urine under the continued effects of atony of
the bladder and catheterism. When complicating general diseases
the affection often runs a very insidious course.

Drugs.—Irritant drugs such as cantharides have been supposed
to give rise to diffuse suppuration and multiple abscesses of the
kidney; but in the cases which have been reported there has
generally been enlarged prostate, stricture, or some other affection
of the lower urinary passages, which of itself may have caused
the renal changes, and in the treatment of which the drugs
have very probably been employed (*see* p. 305).

Traumatism.—Injury to the kidney, ureter, or bladder
is sometimes followed by suppurative pyelo-nephritis. Under
this heading calculi may be classed, for when situated in the
renal pelvis or calyces they produce a mechanical irritation
which leads to desquamation of the epithelium and to chronic
changes in the walls that predispose them to receive any
infection.

From the records of the Middlesex Hospital, I found thirty-
nine cases of pyelo-nephritis amongst the records of 2,610 post-
mortem inspections in the ten years ending 1883. In twenty-
six of them there was suppurative nephritis with more or less
severe pyelitis, but without dilatation of the cavity of the kidney,
and without perinephric abscess. In twelve cases pyo-nephrosis
was associated with the suppuration in the renal substance. In
one case perinephric suppuration resulted from the bursting of
a small abscess through the capsule of the kidney. This occurred
in a man, aged fifty, who had locomotor ataxy, prostatic abscess
and cystitis. Both kidneys had small points of suppuration
scattered in them, and the pelvis of each kidney was inflamed.
Around the left kidney in the perinephric fat there was a large
abscess.

Of the twenty-six cases of pyelo-nephritis seven were unas-
sociated with disease of or involving the lower urinary organs
or ureters. Four out of the seven were unquestionably pyæmic
and the other three were almost certainly metastatic abscesses.
Septicæmia, chronic phthisis, enteric fever, ulcerative endo-
carditis, periostitis, pericarditis, and mammary cancer with recur-
rence in the intestines, were the causes of death in these seven
cases.

In the other nineteen cases there was disease involving the lower urinary organs, the nature of which was as follows:—

Cancer of rectum	2
Cancer of uterus	1
Enlarged prostate and cystitis	3
Abscess in prostate and chronic Bright's disease	1
Rupture of urethra with extravasation of urine	3
Stricture of urethra and cystitis	1
Cystitis from various causes, including three of spinal cord affections	8

In two of this last group of eight cases it is possible that the nature of the disease was pyæmic, for the cause of the cystitis is not mentioned, and one of the patients died with epithelioma of the lower jaw, and the other with carbuncle in the neck.

From a further analysis of the post-mortem records of the Middlesex Hospital, there were seventy-five cases of suppurative nephritis, excluding cases of pyo-nephrosis, occurring in 3,926 post-mortems. Of these, fifty-one were consecutive to diseases of the bladder or pelvic organs, and in the large majority suppuration was present in both kidneys; thirteen were due to the presence of calculi; and the remainder occurred during the course of general diseases. Of these, two occurred during enteric fever, two in acute pulmonary tuberculosis, one in albuminoid disease, one in the course of diabetes complicated by gangrene, one from ulcerative colitis, and four in the course of other general pyæmic affections.

The symptoms may be acute or chronic. The acute form is characterised by high fever which is usually ushered in by rigors of varying intensity, from the most severe shivering fits to a slight sensation of cold; the skin becomes dry and hot, the tongue brown and dry with reddened edges, the appetite is lost, there is great thirst, and constipation is generally very troublesome. If the case runs an unfavourable course all these symptoms rapidly become intensified, and the patient sinks into a semi-comatose condition with muttering delirium, and dies.

If the case runs a more chronic course the symptoms are practically those of uræmia accompanied by the additional effects of the continual absorption of septic material which is taking place. The temperature is not so high, and the symptoms are

often particularly referred to the alimentary tract, which may lead to the digestive disturbances being regarded as the principal complaint; thus the saliva is deficient and the mouth dry, the pharynx is red, there is but little desire for food, and its ingestion gives rise to vomiting and flatulence; obstinate constipation is the general rule, but it is occasionally replaced by diarrhœa. Sleep is disturbed, and there may be some slight delirium at night. The circulatory system is not much disturbed, the pulse may be a little quickened, but no grave alterations usually occur until the end is approaching.

Between the most acute and chronic forms there is every degree of variation; and in some cases of chronic obstruction the symptoms almost imperceptibly progress over a period of many months, and their ultimate gravity may for some time remain unrecognised.

The temperature also varies very greatly; (1) it is in many cases raised throughout the disease, and in some cases runs a very high course, the evening temperature being 105° or 106°; (2) in other cases periods of fever alternate with periods when the temperature is normal and the general symptoms in abeyance.

As an example of the first, or **continued high fever,** I give the accompanying temperature chart (Fig. 38), of a man, aged sixty-
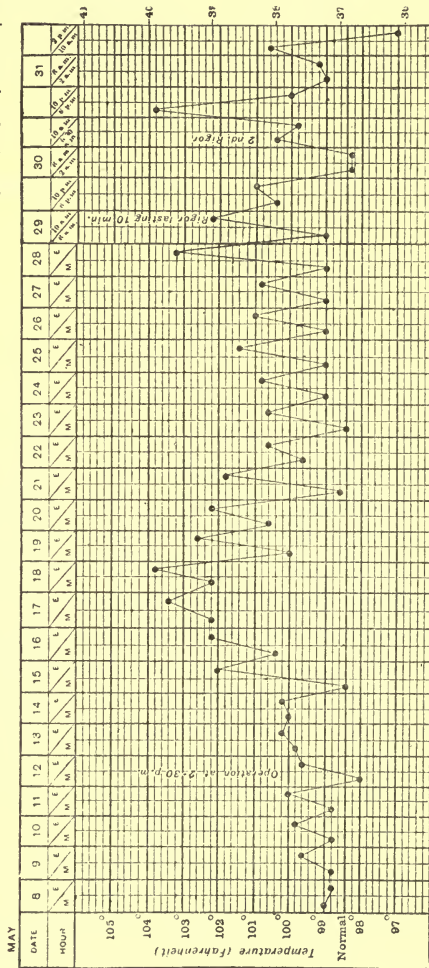

Fig. 38.—Continued Fever in a case of Suppurative Pyelo-nephritis. Temperature Chart of G. L., aged 63.

three, who had dilated and sacculated kidneys caused by very extensive papillomata of the bladder. At the post-mortem examination both kidneys were found to be in a state of suppurative pyelo-nephritis, the right kidney being the most advanced in disease. The ureters and kidneys were much dilated. A glance at the chart shows that though the morning temperature fell occasionally to normal, or even to a little below, it was frequently above and sometimes more than two degrees above the normal; the evening temperature was always high, reaching on one or two occasions nearly 104° Fahr.

As an example of the **intermittent form** I may refer to the case of George C., aged sixty-seven, who succumbed after an illness of six weeks to suppurating interstitial nephritis engrafted upon dilated kidneys, and chronic interstitial nephritis. For four or five years this gentleman had entirely neglected the warning symptoms of retention of urine from enlargement of the prostate, notwithstanding that his condition had necessitated the use of a urinal when travelling or in society.

At length an attack of severe flatulent dyspepsia, combined with obstinate constipation, great thirst, and the secretion of very large quantities of thin limpid urine (eighty to ninety-three ounces a day being excreted), led to the discovery of a tumour to the left of the hypogastrium. The tumour proved to be the bladder filled with over two pints and a quarter of urine, of a thin light colour and low specific gravity. Then the regular use of the catheter commenced, and soon afterwards there came periods, of days together, when the morning temperature rose to 100° or more and the evening temperature to 103°. The periods were followed by five or seven consecutive days when the temperature both morning and evening was normal, as seen in the following records of the case. From September 27th to October 3rd it was as follows :—

		Morning.	Evening.
Sept.	27	99·4°	102°
,,	28	100·2	103·4
,,	29	101·4	103·4
,,	30	101·4	103
Oct.	1	101	102
,,	2	99·2	100·2
,,	3	98·2	

From October 3rd to October 10th the temperature remained normal, but from the 10th to the 16th inclusive it ran :—

		Morning.	Evening.
Oct. 10	. . . . .	100°	103°
„ 11	. . . . .	102	104
„ 12	. . . . .	102	104
„ 13	. . . . .	102	104
„ 14	. . . . .	101	103
„ 15	. . . . .	100	102
„ 16	. . . . .	98·4	

It was a notable feature in this case, that with the subsidence of the feverish attacks not only did the general condition improve, but the quantity of urine diminished, so that it fell, for example, from the 3rd to the 10th of October, to between forty-two and sixty ounces per diem. During as well as before the first attack of fever, from eighty to ninety, and even ninety-three ounces of urine were voided in twenty-four hours ; but later in the course of the case, though the quantity was larger during the febrile than during the non-febrile periods, it never exceeded seventy-four ounces in twenty-four hours, and sixty to sixty-five was about the average quantity. After the third febrile attack it varied from forty-four to fifty ounces, but never exceeded fifty-five ounces. The amount of urea, though from the first somewhat deficient, diminished still more as the case progressed, being sometimes from seven to ten grammes less than the normal. The urine, for a time limpid, pale, acid and of sp. gr. 1015, became, during the last three weeks, offensive and largely charged with pus and bacteria.

In some cases profuse sweating occurs at intervals ; as a rule, the skin keeps moist, and is very often bathed in a clammy perspiration, which towards the end of the disease becomes cold. The tongue is dry, cracked, parched, and brown. Aphthæ often affect the mouth ; the appetite and power of digestion are lost during the fever ; the bowels are frequently costive and distended with flatus, or diarrhœa from time to time may occur ; sometimes there is nausea, and much less frequently vomiting ; and emaciation is very pronounced and rapid. There is little or no pain about the loins, but I have frequently observed that severe spasms, referred to the neck of the bladder, are complained of as soon as any moderate quantity of urine accumulates in its

cavity. After the discomfort due to the parched condition of the mouth and the disturbed state of the digestive organs, these spasms are the chief cause of distress. The mental aspect of the patient is for the most part unaffected; he is perhaps silently anxious and apprehensive about himself, but there is no excitement or active delirium. On the contrary, he may at first read a great deal, but he is apt to doze much over his book or paper; or he lies dreamily, as if under the effect of morphia; but as the disease advances there is more actual somnolence and torpor, he rouses himself with effort, starts during his sleep, and perhaps even mutters incoherently. Though generally conscious or semi-conscious nearly up to the last, coma, which may be profound, often anticipates death by a few hours. The pupils are but little interfered with during the course of the case, unless they are contracted from the effect of opium or morphia.

The character of the urine varies in different cases : if the state of the bladder is unhealthy the urine is of course largely mixed with mucus, pus, phosphates, and perhaps blood; but in other cases, in which the pelvis of the kidney suppurates quickly, the urine is purulent and acid at first, afterwards becoming purulent, phosphatic, and alkaline, whilst the bladder remains in a fairly healthy condition. This is a proof, if any were needed, that pyelo-nephritis does not require for its production an unhealthy state of the bladder, nor the ammoniacal decomposition of urine within the bladder. It is even the fact that these conditions of the bladder may themselves result secondarily from the entrance into the bladder of septic urine from the kidneys. In many cases the amount of urine is increased and the quantity of urea excreted is diminished, owing to the chronic changes which have previously taken place in the kidneys. These characters may be the result of chronic Bright's disease, but are more often indicative of tubular and interstitial changes due to increased urinary pressure from long-standing obstruction to the outflow of urine. If the fever is of the intermittent character the urine is generally more abundant during the periods of fever than between them. Usually it continues to be excreted in considerable quantity up to the end, but the amount is often comparatively decreased towards the close of the disease. This is explained, I think, thus : Each

accession of fever represents the outbreak of the acute inflamma-
tory process in a fresh area of the kidney.   An increased quantity
of blood is thus brought to the kidneys, from which the portions
of the organs not yet affected extract an increased quantity of
water ; after the destruction of this newly attacked area the
increased activity of the circulation in the kidneys subsides for a
time.   Afterwards, there is so much less excretory substance left
for future use ; hence the diminution of urine during the intervals
of immunity from the fever, and also towards the end of the
patient's life.   The presence of albumen varies with the pus
and blood ; generally there is no free albumen.   Hyaline,
granular, and even pus casts may be found, though but rarely ;
for this, if for no other reason, that long before they are shed
the urine has generally become too foul to permit of their dis-
covery.   When the bladder is unaffected, epithelial cells from the
renal pelvis may be discovered in the purulent urine, more
especially if it maintains an acid reaction.

Diagnosis.—When purulent urine of acid reaction, and
containing renal epithelium, is voided by one who is suffering
from pains in the region of the kidney extending along the ureters
to the bladder, we may safely diagnose the existence of pyelitis.
If, on the other hand, there is some disease of the bladder, so
that the renal epithelium, if any be voided, is masked by the
changes which take place in the urine after it reaches the bladder ;
and if, also, as is frequently the case, there are no pains in the
lumbar regions, then pyelitis is likely to be overlooked.

Pyelo-nephritis, when secondary to disease of the bladder, is
too often unrecognised until discovered at the post-mortem ex-
amination.   But this should not be so ; because in cases of
disease of the lower urinary organs, especially when associated
with partial or complete retention of urine, there are two
sets of symptoms which ought at once to lead the surgeon to
a correct diagnosis.   These are fever and the typhoid state
into which the patient quickly passes.   If, therefore, a person
suffering from stricture of the urethra, prostatic enlargement,
tumour of the bladder, cancer of the uterus, or other disease
involving the lower urinary tract, develops a high temperature
at night (*i.e.* from something over 100° to 105° or even 106°),
and becomes drowsy, prostrated, and rapidly loses flesh, has a

dry coated tongue, a quick, weak pulse, a tendency to nausea, and from time to time profuse perspirations, and, it may be, an occasional chill, the diagnosis of pyelo-nephritis admits of no doubt.

From whatever cause arising, suppurative nephritis and pyelo-nephritis are to be distinguished from *acute Bright's disease* by the absence of convulsions, of œdema, and of the harsh and dry skin of Bright's disease. In pyelo-nephritis, if coma occurs at all, it is only for a few hours at most before death ; and the urine, instead of being scanty and of a reddish-brown colour, as in Bright's disease, is abundant in quantity, purulent in character, and but slightly, if at all, tinged with blood.

Pyæmia may generally be distinguished from pyelo-nephritis by the secondary abscesses, and the tender purulent swelling of the joints, as well as by the extreme variations in the high temperature which mark the rigors and the succeeding sweats so characteristic of pyæmia. In pyelo-nephritis there may be no rigor throughout ; in pyæmia some days may pass without any rigor at all, and then two or three may occur in the same day. In pyelo-nephritis, when occasional profuse sweating occurs, it is not as a sequence to a rigor. In pyæmia the sweating follows the rigors. The rigors of pyæmia are accompanied by a rise of temperature, reaching often as high as 105° to 107° ; the succeeding sweats by a sudden fall to normal or subnormal ; but very shortly after this fall the temperature rises again to, and continues at, the high febrile level of the disease. Both in subacute and acute interstitial nephritis I have known muscular pains about the thighs hips, and wrists complained of, and pyæmia has in consequence been suspected ; but in renal disease there is no tenderness, redness, or swelling of the painful parts, and the pain is relieved by gentle friction and soon passes off altogether. In pyelo-nephritis there is not the sweet mawkish odour of the breath, the offensive diarrhœa, or the jaundiced tint of the skin, which often attracts attention in pyæmia.

From *acute septicæmia* pyelo-nephritis is to be distinguished by its less rapid course and by the absence of that restless anxiety, delirium, and tossing of the extremities which accompany the prostration and rapid sinking in septicæmia. There are never in suppurative pyelo-nephritis the purpuric stains in the skin,

nor are there found after death the ecchymoses of internal organs which result from the blood changes of acute septicæmia.

From the *less acute forms of septicæmia*, those, namely, which last from two to three weeks, and in which no secondary abscesses or purulent deposits are formed, it is difficult to diagnose suppurative inflammation of the kidney. Some of the fatal cases of so-called urinary fever of a typhoid form, in which the autopsy reveals no renal changes sufficient to explain death, are really cases of septicæmia. Others are doubtless due to chronic cystitis, or a combination of chronic cystitis and septicæmia. In chronic cystitis, as Brodie pointed out, a low febrile disturbance of the system, attended with great debility, occurs. This low form of continued fever may terminate fatally, especially when the mucous membrane of the bladder is eroded, ulcerated, or sloughing. In pyelo-nephritis also, death is perhaps less due to the distinctive changes in the kidney than to the inoculation of the whole system by septic matter absorbed from the damaged organ or the offensive urine (Beck).

From *typhoid fever* the history and course of the disease, and the absence of Widal's serum reaction and Ehrlich's test, will usually sufficiently serve to distinguish pyelo-nephritis. The temperature chart, and the typhoid character of the general symptoms in the latter disease, are, however, like to those of the later period of typhoid, the temperature rising at night to a point varying from 101° to 104°, and falling in the morning to 99° or lower. Moreover, be it remembered, pyelitis and pyelo-nephritis are occasional complications of typhoid fever.

No difficulty in diagnosis ought to arise between *ague* and secondary suppuration of the kidney. It is asserted, and it is probably true, that rigors after catheterism and operations on the urinary organs are of frequent occurrence in persons who have had ague or lived in malarial districts. But the general and progressive symptoms above described ought to distinguish pyelo-nephritis or suppurative interstitial nephritis from ague.

From *uræmia* the diagnosis is much more difficult. It must be remembered that in some of the fatal cases of urinary fever there is complete suppression of urine for some hours or some few days before death, so that death is more or less immediately due to uræmic poisoning. Uræmia is but a name for a group

of symptoms, and these symptoms may sometimes occur, though they by no means always do so, during the fever which follows catheterisation and operations on the urinary organs.

Septicæmia plays a by no means insignificant part in causing death in certain cases of urinary trouble. In old men with enlarged prostates, in long-standing stricture cases, in typhoid and other continued febrile states, in disease and injury of the spine, and even in simple atony of the bladder, decomposition of the urine occurs, and the mucous membrane of the bladder becomes inflamed and eroded. So, also, in cases of pyelitis from calculus or tubercle of the kidney, the mucous membrane becomes diseased, and fermentative changes occur in the urine. Thus septic material may be absorbed from the bladder or renal pelvis, and give rise to constitutional infection quite independently of instrumental irritation. Again, in suppurative nephritis and pyelo-nephritis, septic material may be absorbed from the purulent tracts of the kidney or from the putrid urine within the renal pelvis, and death may be caused partly by the damage to the kidney and partly by septicæmia.

The symptoms of all these cases are of a low typhoid character, very like those which have been detailed above.

In some cases in which the symptoms during life point most strongly to suppurative pyelo-nephritis, the kidneys are found free of suppuration, sacculation, or dilatation ; and nothing presents itself to the naked eye, either within or without these organs, sufficient to account for the symptoms and death—yet the kidneys are really the cause of death.

Cases occur in which it is expected that well-marked scattered foci or even much larger suppurating areas will be found in one or both kidneys, but at the post-mortem examination these organs are apparently only small and toughened. There is not the slightest trace of suppuration evident to the naked eye ; yet under the microscope there are seen collections of nuclei around some capillary vessels as in the early stage of "miliary abscesses."

Prognosis.—The prognosis of suppurative pyelo-nephritis is very unfavourable, and most patients thus afflicted die within three or four weeks.

In some very acute cases death occurs in three or four

days; the average duration is, however, from two to three weeks.

Occasionally, when the cause of the disease can be removed, and the state of the bladder improved by irrigation, the patient recovers. It is not unfrequent to find in the bodies of persons with other evidences of former obstruction in the urinary passages, shrunken irregular kidneys with cicatrices on their surfaces and in their capsules. Probably in some instances, though not necessarily in all, these cicatrices indicate the healing long ago of small abscesses; but the same appearances are more probably left by severe inflammatory changes in the kidney short of actual suppuration.

C. Fenger states that a pyelo-nephritis in its early stage is amenable to cure, as has been shown experimentally by Rovsing; and Geyl may be right in calling attention to the possibility that pyelo-nephritis, if not far advanced, may disappear when the distal end of the ureter is implanted into the bladder in certain cases of injury to the lower end of the duct.

If the fever be high and of the intermittent character, and is accompanied by marked depression, loss of appetite, flatulence, and constipation; and if each attack of fever leaves the patient permanently weaker bodily and mentally, the prognosis is bad, and the patient will die within a few weeks.

If the fever be high and continuous, the downward course is more uninterrupted and the fatal end will ensue even more quickly.

If the fever, whether intermittent or continued, be but moderate; and if the strength of the patient is not rapidly worn away, a favourable termination may follow on the removal of the cause of obstruction.

Pathology.—In all cases of ascending suppurative pyelo-nephritis due to urinary obstruction, there are pathological changes preceding the actual suppuration which are due to the pressure exerted by the retained urine. These changes resemble those described in the preceding chapter on interstitial nephritis, and consist of dilatation and thickening of the walls of the ureter and pelvis, accompanied by some sclerosis of the kidney substance itself which in old-standing cases causes the organ to become considerably diminished in size and irregular in shape. Microscopically a general increase of connective tissue is observed.

Sometimes the sclerosis is distributed throughout the kidney in patches of unequal extent, and Albarran has described cases in which the remaining healthy portions appeared to have undergone a true compensatory hypertrophy, the tubes and glomeruli retaining their normal structures although much increased in volume.

When the kidney is in a state of suppuration it is usually somewhat increased in volume, but this, of course, must depend largely on the amount of sclerosis that has previously taken place, as well as on the degree of dilatation of the kidney; for the same reason the surface of the organ varies, in some being smooth and in others very granular : there are often also very firm adhesions between the renal capsule and the perinephric fat, and the perinephric fat is often much increased in thickness and toughness. On section numerous foci of suppuration are seen varying in size from a pin's head upwards, and occasionally forming large abscesses involving extensive areas of both the cortical and pyramidal portions of the kidney. Pale yellow streaks are often seen radiating through the pyramids into the cortex, each surrounded by a deep red zone, while the intervening parts of the organ appear healthy to the naked eye. These yellow radiating streaks are often very striking in appearance, and are sometimes the prominent pathological condition present; they constitute the "*nephrite rayonnant*" of Albarran.

When suppurative nephritis affects granular cystic kidneys, the cysts often contain pus and look like small circumscribed abscesses.

Occasionally, when the abscesses are very extensive, they may give rise to perinephric suppuration by penetration of the infection through the capsule, by the lymphatics, or by actual rupture of the capsule itself. The renal pelvis is usually dilated, its walls are thickened, its mucous membrane injected and often ecchymosed, or it may be ulcerated in patches. Sometimes a gritty deposit of amorphous phosphates coats the surface of the pelvis and calyces as well as the apices of the pyramids.

Microscopically there is seen to be a variable increase in the connective tissue, together with an exudation of leucocytes; the leucocytes being chiefly collected in the canaliculi and round the glomeruli, and, though much more rarely, in the blood vessels.

Subsequently the tissue between the tubules becomes affected, and a general purulent infiltration is the final result, epithelium, tubules and connective tissue alike disappearing and becoming replaced by collections of pus.

When the seat of the primary disease is in or in front of the bladder, both kidneys are, as a rule, affected, though one is often more extensively involved than the other. If the primary disease be in the ureter or pelvis of one kidney, that organ alone will be affected. Beck states that he has seen a case in which both kidneys were equally dotted with minute points of suppuration, but in one the pelvis was free from inflammation and the urine therein was acid, whereas in the other the pelvis was suppurating and contained decomposing urine. I have also observed the same disposition of the pathological changes.

Fig. 39.—Swelling of Renal Epithelium ; Nuclei obscured and Protoplasm opaque (probably necrotic). Intertubular tissue in excess. (Cortex × 250.)

Fig. 40. - Degenerated Malpighian Body (hyaline fibroid change). (Cortex × 250.)

The accompanying figures (39–43 inclusive), from drawings by Dr. Coupland, show the changes found in a case of suppurative nephritis following obstruction to the outflow of urine from the bladder, and supervening upon chronic interstitial nephritis.

The changes shown are : (1) marked increase of intertubular stroma, with abundant infiltration of leucocytes in the connective tissue, both of the medulla and cortex ; (2) a swollen, opaque condition of the epithelium, especially in the cortical portion, where the cells were apparently necrotic ; (3) and atrophy of some of the Malpighian tufts with sclerosis and thickening of their capsules. These figures show well the several changes of acute inflammation as

well as the changes in the Malpighian tufts which had been wrought by the antecedent chronic interstitial nephritis.

Albarran made experimental investigations on animals by introducing the organisms into the ureters, and then examining the kidneys at variable times afterwards. The earliest signs were those of congestion; the surface of the kidney became dark red, and subcapsular hæmorrhages were often seen; the size and weight of the organ increased, and about the third day suppuration commenced, which finally ended in dilatation of the renal pelvis and complete destruction of the kidney substance. With regard to the kidney on the opposite side to that upon which the experiment was performed, nothing of note was observed for
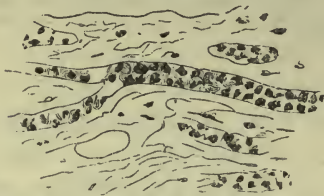
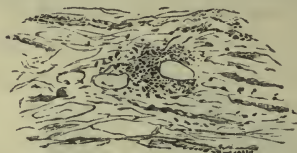Fig. 41.—Nuclear Proliferation of Epithelia. Excess of interstitial tissue, imperfectly fibrous. (Medulla × 250.)

Fig. 42.—Cell Infiltration (inflammatory) of Intertubular Tissue. (Medulla × 250.)

some days beyond a little augmentation of volume and cortical congestion, with occasionally some small ecchymoses; but about the sixth or seventh day some miliary abscesses appeared immediately beneath the capsule, which gradually extended further into the medulla, following the line of the arterioles. The pelvis of the kidney in these cases generally preserved its normal appearance, but in one case it was found to contain a turbid fluid, which was very rich in bacteria.

There has always been some difference of opinion concerning the precise origin of the changes; for while Klebs, Ebstein, and others have held that the uriniferous tubules are primarily affected, others consider that the tissue between the tubules is the first to be attacked, and that the changes in the tubules themselves are only seen later. Dickinson, whilst of opinion that the virus entered the kidneys by the uriniferous tubules, held that it passed thence into the veins, and was thus carried far and wide through the organ. Marcus Beck, on the other hand, considered

that the septic matter passed from the uriniferous tubules into the lymphatic spaces.

It is probable that each of these views is correct, and that the differences depend upon the method by which the infection enters the kidney, for, as we have already seen, the micro-organisms may reach the kidney in three ways, viz. by the urinary tubules, the blood vessels, or the lymphatics ; and it is only reasonable to assume that the mode of onset would vary under these different conditions. Moreover, the question is still further complicated by the fact that two or even three of these conditions may be present at the same time ; for in a case of ascending nephritis the infection may not only reach the kidney by way of the ureter, but it may also be carried to the organ by means of the circulation after having been taken up from some point in the lower part of the urinary tract. Thus it must be borne in mind that although it is for purposes of description convenient to draw a sharp division between the ascending and descending forms, in practice no such line can be definitely made, for the two imperceptibly merge into one another.

Fig. 43.— Cell Infiltration of Intertubular Tissue, and Destruction of Tubules. (Cortex × 250.)

The purulent tracts in the medulla have on each side of them deep red, highly congested streaks, running parallel with the tubules.

With regard to the lymphatics, it was long ago shown by Dr. Steven, by means of injections, that the lymphatics of the ureter communicate with those of the kidney. In this way, therefore, the process of infection may take place freely at the same time that it is passing upwards along the uriniferous tubules. When the infection enters by the tubules the changes would commence in the tubules themselves ; when it enters by the lymphatics the tissues outside the tubules would be the first to be affected.

When the virus obtains entrance by the lymphatics the small abscesses are most numerous, being in some cases almost entirely confined to the cortex. The shape of the cortical abscesses when they spread inwards along the pyramids is *elongated or wedge-shaped ;* but when, as is often the case, they are situated between the capsule of the kidney and the renal substance, and involve the

capsule quite as much as the cortex, the abscesses are *oval or
round*. The position of the microbes in the kidney also varies
with the mode of infection. Albarran has shown that in cases
of infection by the bacillus coli the organisms ascend the medul-
lary canals until they reach nearly to the cortical tubules, where
they form large masses. They can also be seen traversing the
walls of the tubules and passing into the lymphatic spaces. The
bacilli are also found around the glomeruli. In cases of strep-
tococcus infection the method of simple ascension is said to be
less marked, as this microbe tends much more to propagate itself
by the blood vessels and the lymphatics.

In the early stages of the acute form of descending suppurative
pyelo-nephritis the characteristic changes are swelling and desqua-
mation of the tubular epithelium, with exudation of leucocytes and
hæmorrhages, these severally predominating according to the
intensity and nature of the infection. Small points of suppuration
then appear, and the whole organ soon becomes studded with
small abscesses.

Treatment of suppurative nephritis and pyelo-nephritis.—
This is essentially the same as that recommended for acute
and subacute interstitial nephritis without suppuration. Every
precaution should be taken to prevent their occurrence. If
there is any obstruction to the outflow of urine, or any in-
capacity to completely empty the bladder, it should be remedied
or counteracted : thus, stricture of the urethra should be dilated
or divided, vesical calculus should be removed, and the effects of
enlarged prostate counteracted by the early and regular use of
the catheter.

If chronic cystitis exists, daily irrigation of the bladder will
be necessary, both to obviate decomposition of urine and to restore
the mucous membrane to a healthy state. If a stone is impacted
in the lower end of the ureter, it should be removed through
the bladder when possible ; if impacted higher up in the ureter,
or in the pelvis of the kidney, the question of ureterotomy,
nephrotomy, or nephrectomy, must be considered.

Confinement to bed is necessary as soon as inflammation has
once set in. With the view of obviating the tendency to inflam-
mation which is prone to be excited by the use of instruments
on persons with diseased kidneys, and more especially when

men with enlarged prostates are commencing what is called
"catheter life," absolute quietude and confinement to the
house, and to an equable temperament, should be enjoined
before the introduction for the first time of any instrument at
all. Whether with the object of avoiding the slighter forms
of urinary fever, or the much more severe and dangerous changes
of pyelo-nephritis, the above precautions should be strictly observed.

The bowels should be kept well opened, and for this purpose
warm abundant enemata are of great and special service.

The diet should be light and moderate, and should consist
chiefly of fish, milk, or chicken, light farinaceous and milk
puddings, and well-cooked vegetables ; uncooked vegetables or
fruits and butcher's meats should be avoided. Stimulants
should be taken, if at all, in very small quantities ; and during
their administration, if the pulse is quickened, the temperature
raised, or the urine becomes more purulent, they should at once
be discontinued.

Fluids should be taken in only moderate quantity if there
is an abnormally large quantity of urine secreted ; but where
cystitis exists, and much mucus is passed in the urine, Contréxéville
and Kronenquelle, Vittel, and similar waters are useful adjuncts
in slaking thirst and relieving the irritation of ammoniacal urine.
As for medicines, but little can be said in their favour. From
quinine and opium combined, most good seems to result. A
mixture of quinine and citrate of potash has proved of benefit
in some cases.

When constipation exists, and a large quantity of urine is
secreted, I have seen great benefit accrue from a few doses of
ergot of rye. This drug, by acting upon the involuntary mus-
cular fibres of the gut, overcomes the constipation, and by its
influence on the coats of the blood-vessels restricts and regulates
the renal circulation. The constipation, flatulence, atony of
bladder, and general arterial and muscular feebleness, suggest
remedies which will give tone and contractile force to the muscular
fibres of the viscera.

When the febrile attacks take the remittent form, five grains
of quinine in an ounce of lemon juice is sometimes very efficacious
in checking the rise of temperature.

Traube obtained good results from injections into the bladder

of acetate of lead in a solution of from half a grain to one and a half grains in four ounces of distilled water; and the internal administration of pills of tannic acid (from one to one and a half grains) every two hours. He recommends both these remedies because of their antiseptic and antiphlogistic action. Drugs, like tannin, alum, acetate of lead, and chloride of iron, which act as astringents upon the blood-vessels of the mucous membrane and so lessen the excessive secretion of mucus, have been recommended, and certainly deserve fair trial.

B. Circumscribed Suppuration (Abscess of Kidney).

By abscess of the kidney I do not here refer (1) to any of those forms of suppurative nephritis characterised by the development of minute and scattered points of pus the origin of which, as described in the preceding section, may be due to (a) some septic material carried into the kidney by the blood; or (b) to some infective matter derived from disease or injury of the lower urinary organs, and passing upwards either by the ureter and uriniferous tubules of the kidney, or by the lymphatics of the ureter and kidney. Nor (2) do I mean to include cases of miliary abscesses due to the irritation of calculous matter in the kidney; to the decomposition of urine in the pelvis of the kidney from the impaction of a stone in the renal pelvis or ureter; or to any other of the numerous causes of obstruction to the outflow of urine. In short, the varieties of surgical kidney or suppurative nephritis, no matter what their cause, are not here classed under renal abscess. Nor (3) is tuberculous abscess of the kidney included, for renal tuberculosis requires to be separately and specially considered. So, likewise, does (4) pyo-nephrosis, *i.e.* suppuration with dilatation of the kidney.

What we have now to describe is circumscribed suppuration, which results in the formation of one or more abscesses of fair or considerable size *in the substance of the kidney*.

Etiology.—It must be stated at once that renal abscess of large size, involving the greater part or even the whole of the kidney, occurs as the result of the fusing together of a large number of miliary abscesses. When the renal tissue intervening

between the small miliary abscesses rapidly yields to the sup-
purative process, these minute abscesses (whether metastatic
and due to blood poisoning, or secondary and due to infec-
tive material derived from the lower urinary organs) enlarge
and coalesce, until at length the whole kidney may be converted
into one large abscess, or into two or three separate abscesses
of considerable if not large size. Suppuration of this kind may
be limited to one kidney, the other being quite unaffected.

Metastatic and secondary abscesses of large size may be
also formed in another manner, besides that of coalescence
just described. Thus, in pyæmia, or in cases of embolism
derived from ulcerative endocarditis, instead of a number of
minute and scattered emboli followed by minute and scattered
points of inflammation and suppuration, one large vessel
may be obstructed by an embolus and a large abscess may follow
as the consequence.

Mayer reports, in Virchow's *Archives*, a case of this sort due
to ulcerative endocarditis ; a large embolus had plugged the
right renal artery and led to the formation of a large abscess.
So in cases of abscess secondary to disease of the lower urinary
organs, suppuration may extend by continuity from the bladder
along the ureter to the pelvis of the kidney and thence involve
the whole of the secreting and tubular parts of the kidney, instead
of localised and scattered areas of it. In these last-mentioned
cases, however, the pelvis of the kidney and the ureter are
ulcerated or sloughy in patches, and pyo-nephrosis as a rule forms
an important feature in the character of the renal suppuration.
Sometimes, however, a circumscribed abscess may form in the
tubular substance of the kidney as a result of stricture or some
other disease of the lower urinary organs ; a specimen of this
kind may be seen in the Hunterian Museum, in which an abscess
cavity with irregular walls followed an operation for stone.

Wounds, contusions, and lacerations of the kidney, and
kicks, blows, or falls involving the loin or the renal region of
the front of the abdomen, are occasional causes of abscess of
the kidney. Injuries, by causing obstruction by blood-clot
impacted in or by cicatricial contraction or sclerosis of the
ureter, may be followed by suppuration of the renal tissue.
From the appearances in cases upon which I have operated

I have no doubt that small hæmatomata in the renal substance, caused by injury, sometimes become abscesses in which phosphatic concretions are apt to form. Moreover, injury to the kidney may lead to the formation of renal calculus in the injured organ, and in this way may be an indirect cause of renal abscesses of large size. The relationship of injuries to the formation of renal calculi will be further referred to in the chapters on calculus in Vol. II. (p. 43 *et seq.*).

A preparation placed by Dr. Bright in the museum of Guy's Hospital shows an abscess of the kidney the result of contusion or laceration of the renal substance. A quantity of pus mixed with coagulum and blood occupied a space between the fibrous capsule and the surface of the organ. The capsule was greatly thickened, in places to the extent of nearly half an inch. The kidney had been injured nine months before death by a blow on the loin.

Rayer reported a case in which the left kidney of a sailor aged thirty was considerably contused by his falling from a height and striking his left loin against a yard. Death occurred a fortnight after the fall; and in the kidney was found an abscess containing about an ounce of thin offensive pus.

I have previously referred to a case of renal abscess followed by perinephric suppuration and caused by a kick on the loin over a calculous kidney. More usually, when renal abscess occurs as the result of injury to the loin, whether attended with imme- diate injury to the kidney or not, the suppuration of the kidney has been preceded by suppuration in the circumrenal cellular tissue, so that the abscess involves the kidney by spreading to it from without, and is not primarily a renal abscess.

Renal calculus is one of the most common causes of large renal abscess. A calculus which originates in a renal tubule, or one which becomes more or less shut off by inflammatory adhesions from the general cavity of the pelvis of the kidney, not unfrequently gives rise to an abscess in the substance of the kidney; two, three, or more calculi may be contained in as many separate abscess cavities in the same kidney : in extreme cases the whole organ may be converted into a number of separate and non-communicating abscesses, in each of which there may be a calculus. Pyelitis leading to pyo-nephrosis is, however, a more

frequent consequence of the impaction of a stone in the renal pelvis or ureter than is a renal abscess.

Foreign bodies other than calculi, such as a piece of bone, or a fragment of clothing, or a bullet, may gain entrance into the kidney, and lead to a renal abscess of large size.

Dr. Steven * has described an interesting case in which a bristle, partially encased in a branched phosphatic calculus, was the cause of a renal abscess. The specimen was obtained from the body of a man who died soon after sustaining a fracture of the skull. Most of the organs were healthy, but on laying open the right kidney a large quantity of pure yellow pus was found in a series of large cavities chiefly in the upper part of the organ ; and lying in the long diameter of the renal pelvis was a long black bristle one inch and a half in length and of the thickness of a soda-water bottle wire. The lower end of this bristle passed right through and was immovably fixed in a branched phosphatic calculus which had been deposited round about it, and the branches of the calculus projected into the calyces adjacent to it. The bristle lay exactly in the direction assumed by a probe when passed up the ureter into the pelvis. Dr. Steven considered that it must have obtained entrance into the bladder, and then made its way up the ureter to the pelvis of the kidney.

Pathology.—Abscess usually affects only one kidney. There may be one or several abscesses in the same organ. They vary in size from that of a hazel nut, or smaller, to that of an orange or larger. These abscesses may or may not communicate with the pelvis of the kidney, or through the capsule with the circumrenal cellular tissue. When they open through the capsule they lead to a circumscribed perinephric abscess, or to diffused retro-peritoneal suppuration. When they open into the renal pelvis they may partially or entirely empty themselves through the ureter and bladder. When two or more abscesses affect the same organ they may or may not communicate with one another. Often they do not. Sometimes one of the abscesses opens into the renal pelvis and the other does not (Fig. 44). In other cases, two, three, or more abscesses completely separate from one another will each open by a small aperture

* *Glasgow Medical Journal*, September, 1884, p. 187.

into the pelvis of the kidney. This isolation of several abscesses should be borne in mind in performing nephrotomy for abscess. It is not only possible, but very probable, that one abscess only may be opened by the first incision into the kidney ; and this should always be suspected when, on introducing the finger within the abscess, its wall, on one side or the other, is convex and bulging towards the evacuated cavity, or the cavity feels to be shut off from the rest of the calyces and the pelvis of the kidney.

In a very considerable number of specimens of renal abscess the whole organ, including the pelvis, is involved. The pelvis may be little or much dilated ; and the rest of the organ, perhaps greatly enlarged, may be converted into a mere fibrous cyst with large, strongly developed fibrous septa or partitions, and with little, if any, renal substance remaining ; that little may be represented by flocculent shaggy shreds. It is not easy in some of these cases, especially when the ureter of the affected organ is pervious, and the opposite kidney and lower urinary organs are not diseased,

Fig. 44.—Abscess of Kidney, not communicating with the Renal Pelvis.

to say whether the morbid process commenced as a pyo-nephrosis, or as an abscess in the renal substance. It is undeniable that many of the cases reported in the journals and elsewhere as renal abscess are really far advanced cases of pyo-nephrosis.

Symptoms.—These may be either acute or chronic. In the acute cases there is pain, often severe, in the loin and in the front of the region of the diseased organ. Fever and rigors are common, the febrile disturbance tending to assume a typhoid character. The rigors are sometimes marked and frequent ; in other cases only one or two occur throughout the course of the disease, and those at uncertain and irregular periods.

Hæmaturia often precedes the formation of abscess when the

cause is traumatic. When hæmaturia occurs partial suppression of urine for a time may be expected.

The absence of pus in the urine is no contra-indication of abscess ; in many cases there has been none throughout. In other instances, if the abscess breaks into the ureter or pelvis of the kidney, pus, and it may be in large quantity, will be seen in the urine. If a tumour has been formed in the loin the discharge of pus by the bladder will probably be followed by diminution or subsidence of the tumour.

It is not often, however, that any tumour perceptible during life is formed by a circumscribed abscess of the renal substance. If a tumour, with the history or the symptoms suggestive of suppuration, is present, dilatation of the cavity of the kidney may be with fair certainty predicted.

When the abscess is chronic in character, it forms without causing any definite symptoms ; indeed, it may be found at the post-mortem examination without having caused a suspicion of its existence during life. Abscesses which follow injuries are likely to give rise to the symptoms of renal calculus. I have operated on cases in which symptoms attributed to calculus had existed for several years, and have found in the kidney one or two small abscess cavities containing small phosphatic concretions.

In some cases, general impairment of health, occasional chilliness or rigors, obscure aching in the loin, gradual emaciation, and an increasing sallowness or duskiness of skin, indicate some grave disorder, but do not point with any distinctness to its nature.

Prognosis.—In the acute cases a fatal termination may occur in from a fortnight to three weeks, the cause of death being most probably typhoid prostration. If the abscess bursts into the cellular tissue, the intestine, the renal pelvis, or the ureter, life may be prolonged for an indefinite time, and death is tardily brought about by exhaustion or prolonged suppuration.

Possibly recovery may ensue. In some cases it is pretty certain that the contents of the abscess, instead of escaping in any of the directions mentioned, become inspissated and remain quiescent for the rest of life. What I believe to be a good illustration of this is described by Dr. Bristowe in the fifth volume

(p. 178) of the Pathological Society's *Transactions*. A man, thirty-one, whose urine, whilst he was under treatment, contained albumen and phosphates, died from congestion and œdema of the lung and pulmonary apoplexy. In his right kidney, which was small and lobulated and gave a vague impression of fluctuation, there were found after death several cavities varying in size from a walnut to a Spanish nut, filled with a uniform soft but not fluid material, resembling very fine moistened plaster of Paris. These cavities were limited by a thin fibrous membrane. The putty-like contents presented under the microscope a large number of imperfect broken-down cells, like pus cells, a quantity of free granular matter, small oil globules, and a few plates of cholesterine. From the absence of tubercle elsewhere in the body, and from the uniform character and microscopical appearances of the material, Dr. Bristowe regarded it as concrete pus, the result of bygone suppuration.

Treatment.—The treatment of renal abscess may be summed up briefly by saying that it should be opened and drained at as early a period as possible. The treatment of the inflammation in the stage antecedent to the formation of pus has been described in the chapters preceding ; it will depend largely on the cause. If it be due to external violence, restricted diet and fluids, rest, anodynes, leeches, or cupping over the loin, and the constant application of hot fomentations, is the treatment that must be followed. If caused by renal calculus the treatment suitable for the varying phases of this disease will be required. In any case in which there is clear indication of a renal abscess the pus ought to be evacuated through an incision in the loin. It would be quite right in the absence of a tumour, but with the history and symptoms suggestive of suppuration, to make an exploratory incision down to the kidney. If, when the kidney is exposed, pus is found, it is not sufficient to evacuate it with a trocar and cannula. A free incision should be made into the abscess, and the wall of the cavity, if a large one, should be stitched to the edge of the wound to prevent infiltration of the perinephric tissue with pus. For want of such an incision, an untoward result, which otherwise might have been prevented, is but too likely to occur. Several cases might be quoted to prove this, but the following will suffice. Mr. Stanley is reported

in the *Medical Times and Gazette* for 1854 * to have punctured
an abscess in a kidney after making an incision over it in the
loin.   The patient shortly died, and in the large renal abscess
were found oxalate of lime calculi, which, as the reporter remarks,
could only have been reached and removed through a free inci-
sion, but which were not even detected by the puncture.

It will occasionally happen that two or three separate ab-
scesses exist, and an incision into one will not suffice to evacuate
the others.   When, therefore, the finger enters a space in the
kidney which does not communicate with the general pelvic
cavity of the organ, or does so only by a small orifice, the rest
of the surface of the kidney should be carefully manipulated ;
and if fresh pus is found, a second or even a third incision of
the renal substance should be made so as to open the other
abscesses.   Small circumscribed collections of pus may be evacu-
ated, and the abscess walls scraped or well rubbed by swabs
of antiseptic wool or gauze.   I have in several cases removed
wedges of the renal substance, and thus taken the abscess away
en masse.   If the kidney is very much disintegrated it would be
best at once to remove it through the lumbar incision.

* Vol. ii., p. 342

CHAPTER XIII.

URINARY FEVER.

THE term " urinary fever " is used here to indicate the febrile disturbances which frequently follow the passage of a catheter or bougie, or the performance of some other operation on the genito-urinary organs which entails a distinct impression being made upon the urethra or bladder ; it does not include the febrile conditions arising from suppuration of the kidney, which will be found described in the preceding chapters dealing with these diseases, or from uræmia, septicæmia and pyæmia. As will be seen further on, it is probable that cases of urinary fever vary considerably as regards their pathology, and on this score the inclusion of different types under the one heading, which after all is but the chief symptom common to all of them, might at first sight seem unnecessary and somewhat unscientific. But while the pathology of these cases is not at present completely worked out, their clinical importance is enormous, and for practical purposes it seems best to continue to treat them from this standpoint and to group them together as cases of fever which depend on impressions produced upon the urethra, either by the passage of an instrument or some other cause.

It is a well-known fact that the mere passing of a catheter along a healthy urethra into a healthy bladder often causes a very definite shock, as shown by a feeling of faintness, nausea and a sense of chilliness ; and occasionally these symptoms are greatly intensified and are accompanied by scanty or complete suppression of urine, and a fatal termination may ensue, although the kidneys, as well as the rest of the urinary tract, have not been affected by any previous disease. Again, it is equally well known that the commencement of catheter life by an elderly man with enlarged prostate, or the performance of some simple operation for stricture of the urethra, has been followed within a few days or weeks by the death of the patient. It is a striking fact that urinary fever is scarcely ever caused by a severe injury

to the urethra or bladder, or by the introduction of a catheter in isolated fits of painful retention of urine. False passages, ruptured urethra, ruptured bladder, extravasation of urine, scarcely ever provoke it. It is generally brought about by some very slight interference with the urethra, often but by no means exclusively in cases of long-standing disease of the urinary organs, *e.g.* the passage of a bougie in stricture, of a catheter in prostatic disease, or of a sound in vesical calculous affection. But although the passage of an instrument along the urethra is the commonest cause, the condition also occurs after other forms of irritation ; for example, after internal and external urethrotomy, lithotrity, the use of Holt's dilator, the passage along the urethra of bubbles of air, of blood-clots, of a renal calculus or a quantity of oxalate of lime or uric acid gravel, as well as when urine first flows again through the urethra after lithotomy. Guyon found that out of 250 cases of simple dilatation of the urethra by a bougie, urinary fever occurred in forty, *i.e.* in about a sixth of the total number of cases ; in all these the onset took place on the same day as the operation and usually about six or seven hours after the bougie had been passed.

Moreover, it is not as has sometimes been stated in any particular part of the urethra that the irritation must be excited ; the fever arises from causes which act in front of as well as behind the bulb of the urethra, and one of the most severe cases of transient paroxysmal fever which I ever witnessed occurred in a gentleman aged seventy-two with cancer of the penis. Whilst micturating, the disease suddenly opened into the urethra just behind the glans, and some of the urine dribbled through the fistula thus formed. He was at once seized with a rigor so severe that it caused him to fall, and it was described to me by his nephew, who witnessed it, as appalling. It lasted about half an hour. On my arrival, an hour or more afterwards, the temperature was 103°. For several hours he remained in an alarming condition, faint, sick, aching all over, and with a tendency to delirium. By the next day he had quite rallied, and continued free from any similar attack until his death, from the cancer, nearly three weeks afterwards.

I shall, under intermittent urinary fever with swelling of the joints, refer to a case in which the fever was excited by

irritation about an old fistula of the urethra, situated within one
and a half inches of the meatus ; and I shall also describe a
case of the recurring acute paroxysmal form of fever due to
the passage of a bougie through a stricture situated three inches
from the meatus. I have known one instance of an acute
transient attack in a female after an operation for vesico-
vaginal fistula.

The presence of renal disease, stricture, enlarged prostate,
and any chronic affection of the bladder, all predispose to the
fever which in these diseases is more easily produced and is of
greater severity than when occurring in a healthy subject.

It seems, therefore, that only certain impressions on the mucous
membrane of the urethra and bladder tend to produce fever, and
that the fever is not produced with any certainty, for when two
patients are catheterised under exactly the same conditions one
may suffer and the other escape. It seems also that these im-
pressions may take effect on perfectly healthy organs, but are
more likely to do so on organs which are already the subject
of disease.

The exact method by which the simple passage of a bougie
or catheter gives rise to such a general reaction, accompanied
by fever and perhaps retention of urine, is not at present pre-
cisely known. There are two principal views held : one is
that the condition is a nervous one, produced by the irritation
of the urethral nerves, causing a far-spreading effect which is
primarily felt by the kidneys, and secondarily by the entire system.
The second view regards all these cases as being due to an
infection of the genito-urinary tract, followed by the absorption
of toxines ; and this view is the natural outcome of the bacterio-
logical work which has been done during the last few years.

As to the first view, there is a very close anatomical connection
between the nerves of the different parts of the genito-urinary
system, and it is not difficult to believe that an irritation of the
nerves of one part might produce reflex effects in other parts.
It is on this ground that the supporters of this theory explain
the acute effects which are produced on the kidneys, namely,
suppression of urine, accompanied by marked congestion of the
organs. Moreover, the cases are often very transient, and in
this way suggest a passing functional condition which might

be produced by a moderate vasomotor disturbance. Again, in nearly all cases in which a catheter is used for the first time there is a certain amount of "shock" produced, quite apart from any general febrile disturbance which may follow; this initial shock is undoubtedly nervous in origin and has its counterpart in the intense nervous disturbances which often accompany operations on certain other parts of the body, as for instance when the spermatic cord or the optic nerves are severed.

Another point which has been urged in favour of the nervous origin is the fact that febrile disturbances often manifest themselves at an exceedingly short interval after the operation; this, however, is not of much value, since under certain conditions septicæmic symptoms are very rapidly developed, and the possible fallacy of this argument has been shown in a case recorded by Albarran, in which a patient died very soon after an internal urethrotomy. The man was seized with a rigor about an hour and a half after the operation, the temperature rose to 104°, and death took place in twelve hours. At first sight this case would appear to support the nervous theory, especially as regards the interval between the operation and death; but at the autopsy there was, in addition to great congestion and ecchymoses of the kidneys, a small collection of pus situated behind the urethral stricture which contained the bacillus coli and other organisms, and it is highly probable that death was due to the absorption of these organisms through the wound. It must also be acknowledged that since the importance of absolute cleanliness in the use of instruments has been more fully recognised, cases of urinary fever directly traceable to the passage of an instrument are fewer and of less severity than they were formerly, and Guyon now teaches that by careful choice of instruments and by equally careful handling, so that the urethra be not unduly dilated or exposed to severe friction, all unpleasant symptoms may usually be avoided.

Another important point to be remembered in the discussion of these cases is the variation in the virulence of bacteria, and this may possibly be, at any rate in part, an explanation of the reason why the attacks are so uncertain in their occurrence.

In one case a slight injury to the mucous membrane of the urethral canal is followed by the absorption of virulent organisms,

in another by the absorption of organisms comparatively harmless ; and further there is the question of the varying susceptibility of each individual patient to be taken into account.

In conclusion, it is probable on the whole that a large number of these cases do depend upon infection ; others, however, cannot at present be clearly attributed to this cause, and it is most likely that in many of them the nervous element, which undoubtedly is a factor to be taken into account in the performance of urethral operations, plays the chief part.

Practically, this much may be stated, that however careful an operator may be in the choice and the cleanliness of his catheters, bougies, and other instruments, cases of urinary fever, fortunately for the most part mild ones, will occur from time to time, and these often after the most simple and apparently trivial operations ; and, moreover, the same person may suffer after the passage of a catheter at one time and not at another, although the same instrument be used and as far as can be judged the same gentleness and strict precautions are observed on both occasions. I have often known one solitary transient paroxysm to occur during a course of catheterism extending over some weeks.

The clinical varieties of urinary fever may be classified as follow : —

1. Acute transient paroxysmal fever.
2. Acute or subacute recurring paroxysmal fever.
3. Acute or subacute intermittent paroxysmal fever.

1. THE ACUTE TRANSIENT PAROXYSMAL FEVER is the commonest effect of the simple passage of a catheter or bougie, and it varies greatly in intensity and duration.

It is always ushered in by a rigor, which may however, in mild cases, amount to nothing more than a sense of chilliness, and this, together with a rise of temperature of one or two degrees and perhaps some nausea, sense of faintness and headache, may constitute the whole attack and entirely pass off in from three to six hours.

On the other hand, the rigor may persist from half an hour to an hour or even more, and is sometimes of a very violent description, so that the chattering of the teeth and severe tremors of the whole body are distressing to witness. The temperature during this stage rises rapidly and often reaches 105° or 106°.

As a rule the intensity and duration of the whole attack vary with the degree of the rigor, which, if severe, usually indicates that the attack will be prolonged.

The shivering stage gradually passes into one of heat, characterised by a dry burning skin, flushed face, and accelerated respiration, and this stage again is finally replaced by profuse perspiration.

The temperature, which rises so rapidly during the rigor, remains high for a short time after its cessation, and then falls by degrees until during the sweating stage it often subsides to a point below normal.

Vomiting, headache, pain in the back and limbs, and injection of the conjunctivæ are the other prominent symptoms of a severe case.

The urine may be completely suppressed, or secreted in much smaller quantities than normal, in which case it is often turbid and contains albumen and blood.

Disturbances of the digestive system are generally a prominent feature, and are characterised by nausea and vomiting sometimes quite uncontrollable, and often accompanied by diarrhœa. The tongue is dry and furred, and the saliva often gives an acid reaction. The respirations vary from a slight increase to positive dyspnœa, and the pulse becomes increased in frequency. Delirium is another frequent complication and varies from vague wandering to actual violence : according to Guyon this symptom, when present, nearly always commences during the cold stage, occasionally in the hot stage, but scarcely ever in the sweating stage.

Such an attack, even when most severe, if it occurs in a young and healthy adult, or even in an aged person with healthy organs, will in all probability be recovered from, and the patient will feel in his usual health again in from twenty-four to thirty-six or forty-eight hours. If, however, the patient be infirm, weakly, or unhealthy ; if he has a feeble, irregular circulation, a fatty heart, or some other serious organic lesion, he may succumb within as short a time to the shock of the fever.

The condition of the kidneys in fatal cases of this variety is almost invariably one of intense congestion, which accounts for the scanty, albuminous urine passed during life, and its occasional

complete suppression. In some cases blood has been extravasated
into the tubules of the kidney, and in others ecchymoses have
been observed beneath the capsule.

Lord Lister, Sir Joseph Fayrer, Sir Henry Thompson, Sir
William Mitchell Banks, and others have all recorded cases of death
from urinary fever, within a few hours or days, in which the
kidneys were more or less actively and intensely congested.   Marcus
Beck recorded a case of suppression of urine and death on the
third day, in which the microscopical examination of the kidneys
led him to the conclusion that during the first few hours the
renal vessels became dilated, and that then a considerable exuda-
tion of small round cells took place into the intertubular tissue
throughout the kidney , this exudation at the same time com-
pressed both the blood-vessels and the renal tubules, and thus
lowered the blood pressure in the Malpighian tufts, and obstructed
the flow of urine in the tubules.   In this manner equilibrium
was produced between the blood pressure and the pressure of the
urine in the tubules, all exudation from the Malpighian tufts ceased,
and complete suppression was the result.   In this case the kid-
neys were large, tough, and pale in colour (anæmic in fact),
and quite free from vascular engorgement.   Yet this was no
proof that during life there had not been a period of acute con-
gestion.   It is only after a very careful microscopic examination
that the kidneys can be pronounced free from the effects of
such a degree of hyperæmia as may end fatally ; and it is impos-
sible to say in any individual case what amount of congestion
is required to cause death.   If the kidneys are granular or
fatty, or have undergone chronic interstitial changes, it is easy
to see how serious this fresh disturbance may be, even though
it be simply due to vaso-motor action, excited in a reflex manner
by the urethral nerves ; while, on the other hand, if it is due to a
septic infection (as it certainly often is), the previously diseased
kidneys can offer but little resistance, and an acute or suppurative
inflammation may result.

Another way in which, after long-standing obstruction to the
outflow of urine, the kidneys may be brought into a condition pre-
disposing to serious pathological changes, is by the vascular tension
induced by catheterisation.   In kidneys long subjected to intrarenal
urinary pressure, a state of active congestion is brought about by the

release of the distension on withdrawing the urine. This congestion tends to stimulate a degenerated structure into extra functional activity by bringing to the secreting apparatus, within a given time, an extra amount of blood for it to work upon. The increased flow of blood to the kidneys cannot be even in part controlled or checked by the natural elasticity of the solid organs and their capsules, because the pre-existing chronic changes have led to the adhesion of the over-stretched capsule, not only to the degenerate renal substance, but also to the surrounding fatty tissue ; and further, the elasticity of the renal substance itself has been destroyed by the intrarenal pressure of long pent-up urine. The resisting power of such a kidney is very weak, and inflammation and suppuration are easily superadded if any infection reaches the organ, either through the circulatory system or by any other channel. The same mechanical effect is produced upon the mucous membrane of the bladder, but, in all probability, to a much less extent, because the bladder can collapse, and receives pressure and support from the circumjacent intestines and other viscera. There can be little doubt, therefore, that in these cases the morbid changes commence at once in the kidney, from which they perhaps spread downwards to the bladder ; and not in the bladder to pass upwards to the kidneys. That this is so is clearly proved, in some cases by the chronological order of the symptoms, as well as by the post-mortem appearances of the urinary organs.

2. THE ACUTE OR SUBACUTE RECURRING PAROXYSMAL FEVER is very similar to the acute transient form just described, and varies in degree to the same extent. It differs from the transient form in being more prolonged, and in the repetition of rigors, and of the elevations of temperature. It rarely lasts for less than three days, and often continues four or five days, or a week. It has the same tendency towards recovery ; but may terminate fatally when it occurs in the very aged, in persons of highly nervous organisation, or of delicate or unhealthy constitution. It commences in the same manner, with a slight or severe rigor, lasting from a few minutes to twenty minutes or half an hour ; it comes on usually after the first act of micturition, though it may not be until after the second

or third act, and is sometimes independent of micturition alto-
gether. The temperature rapidly rises, until by the end of the
rigor, or shortly after it, the thermometer reaches some point
between 102° Fahr. and 107° Fahr.; it then declines by stages,
and within six to eighteen hours will fall considerably, probably
nearly to or below the normal. A second or third rigor will
follow, and again the temperature will rise three, four, or five
degrees or more, and again it will subside steadily through a
few hours. The variations in temperature may recur without
a repetition of the initial rigor. These recurring rigors and ·
alternations of temperature will take place once, twice, thrice,
or oftener, and will happen within two successive days, or be
spread over three or four or more days, according to the mild-
ness or severity of the attack. Ultimately, when the fever has
passed, the temperature falls to or below normal; if below normal,
it will so remain for twenty-four hours or longer, before it as-
cends to the healthy standard.

During the whole course of such an attack the patient looks
and feels excessively ill. When first seized, he has a sense of
the utmost exhaustion, may be too helpless to walk to his bed,
or unable to undress himself. His face is dusky, his eyes suf-
fused, tongue dry and coated, appetite quite lost ; nausea or
actual vomiting of a dirty greenish fluid distresses him, and he
complains much of frontal headache, pain in the loins or hypo-
gastrium or back of his neck, or in his limbs. Perhaps he will
express himself as being "sore all over," or say he feels as if
he had been "beaten all over with a stick."

The urine will contain albumen or perhaps blood, or there
may be partial or complete suppression. The bowels may be
either relaxed or constipated, more often the latter. The con-
dition of the skin is not the same in all cases ; in some, profuse
sweating follows each rigor ; in others, there is no marked sweating
stage, but after the rigors the skin is hot and moist, and later on
is hot, dry, and pungent. With the permanent reduction in the
temperature the other symptoms pass off, the appetite returns, the
bowels act naturally, the urine is secreted in normal quantity, ceases
to be tinged with albumen or blood, and resumes the normal specific
gravity and other characters ; in fact, the patient is well again.

Both the transient paroxysmal and the recurring paroxysmal

forms may occur again and again in the same person after fresh irritation ; or, what is perhaps less frequent, the transient form may be excited at one time and by one kind of irritation, and the recurring form at another time or by a different kind of irritation. A remarkable case of this kind was recorded by me in my work on the "Surgical Diseases of the Kidney" (1885). It occurred in a Dutchman, aged sixty-four, suffering from retention of urine and severe hæmorrhage into the bladder, due to an enormous number of small prostatic calculi. It afforded an excellent illustration of a striking fact, and one which has great importance in treatment, namely, that the division of a stricture of the urethra takes away the disposition to urinary fever.

3. THE ACUTE OR SUBACUTE INTERMITTENT PAROXYSMAL FEVER.— This form of urinary fever, except when associated with chronic interstitial nephritis, is rare, and although it appears in many cases to be directly excited by the simple passage of a bougie or catheter, it usually depends in reality upon septic absorption from some part of the urinary tract, and its septic nature is sometimes indicated by effusions into joints and other septicæmic symptoms which complicate it. When due to congestion, not to inflammation of the kidney, it may, like the other two forms, be either slight or severe. It may be either acute or subacute, that is, each febrile period may be high and the general symptoms severe, or the rise in temperature may be only moderate, and the general symptoms mild. In either case, the state of the patient between the febrile attacks is one of considerable improvement, though he will not describe himself as feeling well, and will, indeed, often say he is far from being so.

If any complication, such as swollen joints or effusion into the sheaths of tendons or other local trouble complicates the fever, the patient will have to keep his bed, and will be more or less severely ill throughout.

As a rule, the termination of these cases is favourable ; the intervals between the accessions of febrile temperature lengthen ; and after three, four, or more elevations, which occur chiefly towards evening, the temperature keeps low, and the patient gradually recovers health and strength.

When the symptoms have been severe, and the patient is much

shaken by the fever, a herpetic eruption on the face has some-
times been the harbinger of recovery (P. Heron Watson). When
the fever is going to take an unfavourable course, it assumes
a continued form before death. This stage is marked by the same
typhoid symptoms as are characteristic of interstitial nephritis.
At the post-mortem examination the kidneys will be found in-
flamed or suppurating.

This intermittent form resembles, in some respects, the re-
curring paroxysmal fever ; but with this difference, that in the
latter the variations of temperature occur in quick succession,
and within a very limited space of time, whereas the intermittent
fever lasts over some few weeks, or even months. But there
are these further distinctions : the recurring paroxysmal fever
comes on suddenly with a rigor within a few hours after the
provocation, and the patient is very ill throughout the attack,
from which, however, he, as a rule, recovers ; and he does not
suffer a relapse, except as the result of a fresh provocation. The
intermittent fever often comes on insidiously some days after
the use of an instrument, or after exposure to some other cause
of irritation ; its onset is not always marked by a rigor ; relapses
take place without any fresh provocation from without ; and
the patient, as previously stated, has intervals of comparatively
fair health between one febrile period and another. It is this
form of fever which is so often described as " aguish " ; and
surgeons ought to be mindful of the fact that some patients
with stricture of the urethra are liable to these intermittent
feverish attacks, and are frequently treated for ague. Enquiry
in all doubtful cases of " aguish attacks " in adult males should
always be made for, and will sometimes lead the surgeon to the
discovery of, a long-standing stricture of the urethra.

Besides the rheumatic pains so much complained of in certain
cases, another symptom occasionally prominent in intermittent
urinary fever is swelling of the joints. Perhaps the joints most
commonly affected are the knees and ankles, but I have seen
the elbows, wrists, and shoulders also involved. There is con-
siderable swelling from effusion into the synovial cavity of the
joint, but no redness, heat, or tenderness, although some amount
of pain is complained of when the joint is moved. Sometimes
the sheaths of tendons are similarly swollen, and there may be

also œdema of the cellular tissues of the lower limbs. I have seen the feet and legs pit on pressure. These cases are generally very chronic, three, four, and five months being required for their cure. During this period the patient feels exceedingly weak and depressed; and from time to time, at variable intervals (sometimes only of a few days), there is an exacerbation of temperature in the evening; 101° or 102° being often reached. On these days the patient feels worse, looks ill, has, perhaps, a dusky complexion, and loses his appetite entirely. The effusion into the joints and tendon sheaths is not in the first place purulent, and as a rule does not become so in aged or weakly subjects, though it may do so, just as the synovial fluid poured out after a slight injury occasionally does.

A man with stricture who is prone to "aguish attacks" may in one of them find himself affected by these arthropathies. Such a case came under my notice some time ago in the person of a physician, since dead, who had often suffered from attacks of intermittent fever coming on without any known cause. He had "had such attacks, lasting from a few days to a week or longer, all his adult life, and did not know to what they were due; they had sometimes been considered gouty." On my first seeing him during one of these attacks, his joints were for the first time affected in the way just described; but I learnt moreover that he had had a stricture of the urethra just behind the meatus, and a fistulous opening close to the stricture and under cover of the prepuce for over thirty-six years. There was a slight purulent discharge from the fistula, and some excoriation of the surface of the glans around it; a No. 7 catheter had been passed at frequent intervals during all these years. I now had no difficulty in understanding not only the existing attack which I followed throughout, but the previous attacks of which I had heard the description. The illness was protracted, many joints were involved, and for a while it was feared one knee-joint would suppurate; but under the influence of tincture of iron internally, soothing and disinfectant washes to the fistula, and warmth and compression to the affected joints, a complete recovery with proper use of the joints was obtained in from four to five months, between two and three of which had been passed in bed.

Prognosis.—It is exceptionally rare for any serious termination to follow any of the above types of urinary fever, even though the attack be violent. When the kidneys are healthy the febrile storm, however appalling for the time, generally passes over, and the victim of it soon recovers. Even though the urine be completely suppressed for many hours, recovery under appropriate treatment is the rule. I have never had a fatal case in my own practice, nor have I known of one in the practice of my colleagues. It is, however, undeniable that death is caused by each form of the fever; and, as stated above, fatal cases, in which no *organic* disease of the kidney was found, have occurred to Mitchell Banks, H. Smith, Fayrer, Lister, Henry Thompson, Velpeau, Heyfelder, and others. When antecedent renal disease exists rapid death is by no means unfrequent as the result of the acute paroxysmal or recurring paroxysmal seizures (Beck, Erichsen, and others); and a fatal termination is only too frequent after two or three weeks' duration of the disease as the result of acute or suppurative nephritis.

Evil consequences short of death may ensue. Sir B. Brodie has recorded a case in which the introduction of a small gum catheter through a stricture was followed by a severe rigor and an attack of fever attended with inflammation of the muscles of the neck, from the effects of which the man never entirely recovered. He also alludes to another case in which a rigor followed the application of caustic to a stricture, and an attack of mania lasting nearly one month was the sequel.

Diagnosis.—The transient or "congestive" forms of urinary fever are to be distinguished from acute *interstitial nephritis and suppurative nephritis* by the suddenness and rapidity of the symptoms, and the short duration of the fever; by the clinical history of the case, and often by the presumably healthy state of the kidneys; and especially by the state of the lower urinary passages at the time of the fever. The intermittent fever is the form most likely to be confused with interstitial nephritis, and indeed, as we have seen, the two may co-exist. A careful consideration of all the clinical symptoms taken in conjunction with the previous history of the case will, however, often make it clear that the intermittent urinary fever has become engrafted on to the already diseased kidneys; a conclusion which

is of considerable practical importance since the existence of the two conditions together naturally makes the prognosis far graver than when either is present alone.

From *septicæmia*.—To those who consider all these cases to arise from septic absorption, this differentiation may seem unnecessary, but clinically it must be recognised that whatever the origin of these cases they usually run a course which is different from septicæmia arising from most other causes.

In the acute transient and the acute remittent fever, their sudden onset, and short and usually favourable course, are sufficient to distinguish them; and taken with the fact that they have commonly been preceded by an operation on the urethra their nature becomes still more plain. The fever arising from a continued absorption of pus from the urinary passages, as in ascending pyelo-nephritis, will be distinguished by its duration and by the insidious and progressive nature of the illness, while an examination of the urine will generally at once reveal the nature and source of the infection.

In the intermittent form of urinary fever the patient's comparatively good health between the attacks serves to distinguish it from an infection due to constant absorption of septic matter; and where as in many of such cases the nature of the disease is undoubtedly due to infection, the symptoms point to an intermittent absorption of some toxic substance into the circulatory system, and this is often in some way excited by the passage of an instrument. It may be that in some cases there is a small collection of pus in the urethra which every now and then, owing to some impediment in its drainage, is absorbed into the circulation and gives rise to an intermittent attack of fever; or it may be due to variations in the virulence of organisms under conditions which at present are not fully known. In any case it is essential both for accuracy in the prognosis, and for the treatment of the patient, that this intermittent form of fever be carefully distinguished from that due to the constant absorption of pus from a widespread suppuration along the urinary tract

The same considerations will usually enable the condition to be distinguished from the ordinary forms of *pyæmia*, which are accompanied by delirium and the formation of metastatic abscesses. The third form of urinary fever, especially when accompanied by

swelling of the joints, is the most liable to be confounded with this condition, but the absence of redness and tenderness of the swollen parts, as well as of frequent rigors and subsequent profuse sweats, the delirium, high pyrexia with irregularly recurring exacerbations, the metastatic abscesses, foul breath, icteric coloration of the skin, which are all prominent features of pyæmia, will enable the true nature of the case to be recognised.

From *uræmia* the diagnosis is much more difficult. It must be remembered that in some of the fatal cases of urinary fever there is complete suppression of urine for several days, so that the mode of death is partly by way of uræmia. But in the more rapidly fatal cases death occurs before uræmia can take effect ; moreover, in cases of suppression a large quantity of urea is got rid of by vomiting ; and, finally, in some few fatal cases there is no suppression. The absence of coma, drowsiness, and convulsions, and (after the rigor has passed off) of blueness or lividity of the skin, and the retention of consciousness, will serve to exclude uræmia.

Ague ought not to be mistaken for urinary fever, nor the fever for ague. The sudden onset ; the presence of stricture or a known cause of irritation in the urethra or bladder prior to the rigors and feverishness ; as well as the absence, in many cases of urinary fever, of all malarial influences ; and, finally, the complete cure of the " aguish " symptoms, by the cure of the stricture of the urethra or the removal of some other source of urethral or vesical irritation, will serve to distinguish urinary fever from ague.

Gonorrhœal rheumatism. — Urethral arthropathies are excited by other causes than gonorrhœal urethritis. Any purulent discharge from the urethra, balanitis, and, in the female, vaginal and cervical leucorrhœa, as well as gonorrhœa, have been known to cause them. Hence, when fever, complicated with swelling of the joints, and a urethral purulent discharge, affects an adult who has stricture of the urethra, the diagnosis between urinary or urethral fever, and gonorrhœal synovitis or urethral rheumatism, is clinically impossible, and only to be determined by the discovery of the gonococcus in the discharge.

From another form of gonorrhœal rheumatism, that, namely, in which the fibrous tissues of the joint are chiefly, and the

synovial membrane only secondarily affected, urinary fever is to be distinguished : (1) by the presence of diffuse, sometimes widely diffuse, redness and pain in the tissues over the inflamed fibrous structures, and of the softening, and consequent abnormal movements which may be communicated to the joints in gonor- rhœal rheumatism ; (2) by the more severe constitutional dis- turbance and more marked synovial effusion in urinary fever ; (3) urinary fever occurs generally in males, and is commonly associated with stricture of the urethra ; (4) in urinary fever, complicated with joint affection, there will sometimes be a past history of previous and repeated " aguish attacks " in which the joints were quite unaffected ; (5) gonorrhœal rheumatism occurs in young persons, in females as often as, or even more often than, in males ; it comes on during the acute stage of gonorrhœa, or of some other purulent discharge from the genital organs ; and is apt to be confounded with phlegmonous erysipelas, lym- phangitis, or phlebitis. It seems to be very prone to affect recently-seduced girls and young married women who, having a purulent discharge, are also pregnant ; * (6) gonorrhœal rheu- matism is often complicated by inflammation of the sclerotic or iris ; it rarely or never causes suppuration of the joints, but is prone to terminate in fibrous ankylosis.

In gonorrhœal rheumatism and in urinary fever several joints may at first be affected, as in acute rheumatism ; but at a later stage one joint becomes chiefly implicated ; in both diseases the evening temperature will often rise to 101° or 102° ; and in both, the general and arthritic symptoms will improve with the cure of the urethral or other purulent discharge on which it depends.

Pathology.—The pathological changes in urinary fever have been indicated under the etiology of the disease. In urinary fever, as distinct from the fever of acute and suppurative nephritis, the only pathological change discoverable outside the urethra and bladder is more or less congestion of the kidney. The degree of congestion varies from a slight mottled redness to the most intense engorgement of the renal vessels, extravasation of blood into the renal tubules, and greatly increased softness and

* For an excellent account of acute gonorrhœal rheumatism the reader is referred to an article by the late Mr. Davies Colley in the *Guy's Hospital Reports* for 1882.

friability of the renal substance. The almost complete absence
of congestion found after death in some fatal cases is no criterion
of the state during life. After death the renal vessels, which
during life were over-distended, rapidly empty themselves, and the
blood flows back into the large abdominal vessels. How little
evidence may remain of the severe shock which during life had
caused a sharp and fatal paroxysm of fever is seen in Mitchell
Banks' case. Half an hour after a No. 4 metallic bougie had
been passed through a tight penile stricture the patient vomited,
had a rigor, followed by a second rigor in two and a half hours,
and death in six and a half hours. At the post-mortem there
was no injury of the urethra or laceration of the stricture, and
only slight congestion of the kidneys; a tablespoonful of thick
muddy urine was in the bladder, and a little thick turbid urine
escaped from the calyces of the kidney on pressure.

In other cases, as in Lister's and Henry Thompson's, for
example, the kidneys were found in a state of the most in-
tense congestion; in Lister's case of rapid death preceded by
complete suppression of urine, the kidneys, which had been pre-
viously perfectly healthy, were "affected throughout with most
intense inflammatory congestion."

In Thompson's case death occurred within fifty-four hours
of passing an instrument through a narrow stricture; the kid-
neys were found "congested to an extraordinary degree, and
their substance was so soft and friable as to give way under
gentle pressure. Very rapid changes had evidently taken place
in these organs, but no sign whatever of inflammation existed
in any other part of the urinary apparatus."

The appearances vary according to the length of time between
the initial rigor and death: when several hours have elapsed
the renal changes may be expected to be most marked; when
only a few, as in Banks' case, the post-mortem signs of con-
gestion are slighter.

In cases of intermittent urinary fever which have passed into
a continued fever and then ended fatally, the kidneys have
usually become the seat of acute inflammation or suppuration;
this, however, may only be discoverable by the microscope.

The kidneys have been found healthy in other cases in which
death has been caused by chronic cystitis, or by septicæmia the

result of absorption of septic material from the putrid urine. A few years back it was contended in a discussion on "catheter fever" that fatal cases of a low continued fever arise from the use of the catheter, and that an autopsy reveals no definite visible structural lesion adequate to account for death. When this is true as regards the kidney, and it very rarely is so, cystitis is found, and the bladder is the reservoir of decomposing mucus and urine ; its "mucous lining, congested and in part eroded, and everywhere coated with a greyish-white stinking mucus" (Sir A. Clark), has doubtless been the starting point of blood poisoning. In such cases it matters little whether the ureters, pelves, and substance of the kidneys are inflamed or not; septicæmia can arise from the absorption of putrid urine from the bladder or urethra. Such cases may perhaps more correctly than by any other name be called urinary septicæmia ; but they are improperly called catheter fever, because they are not set up entirely through the irritation of catheterisation, and may occur quite independently of the use of instruments.

The pathological cause of the joint troubles in urinary fever is, as has been previously pointed out, probably of a septic nature.

Treatment.—The surgeon's efforts should be directed to the prevention as much as to the cure of urinary fever. To avoid shock, convulsions, or any of the paroxysmal forms of urinary fever, it has long been the practice to prescribe a dose of hot spirit and water immediately before, or after, the first introduction of an instrument ; to which, for nervous or excitable persons, or those whose urethra is very sensitive or irritable, a few minims of tincture of opium may with advantage be added. If there is any known tendency to urinary fever, or if the patient has lived in the tropics or been the subject of malarial fever, two minims of *Fleming's tincture* of aconite, or 5 to 20 grains of quinine in lemon juice, with or without a drachm or half a drachm of liquor morphiæ, should be given at once after the use of the instrument ; or a short course of these drugs should be tried for a few days beforehand ; or a dose of opium or a subcutaneous injection of morphia should be given immediately before the operation. In highly nervous persons, and in those who are mentally or physically much depressed, or excessively sensitive to pain, it is well to give an anæsthetic before introducing an instrument at all. It is by no

means those who suffer most from catheterisation who are most
prone to urinary fever ; but manipulations under chloroform are
very much less likely to be followed by urinary fever than when
made without the aid of anæsthesia. I have known men suffer urinary
fever from the simple passage of a bougie who have borne prolonged
manipulations when under chloroform without having any ill effect.

In cases in which the urethra alone requires to be examined,
it is not necessary to take further precautions than those just
named.   But in a person whose bladder is to be explored, or
the regular use of the catheter for retention commenced, previous
rest upon the sofa or bed for two or three days is desirable.
The instrument should be first used, not in the consulting
room of the surgeon, but in the bedroom of the patient.   To
explore a bladder for stone without previous preparation of
the patient, or to empty the bladder of a man with enlarged
prostate who up to the time of his seeking advice has been
going about his business as usual, are things to avoid when
possible.   Many a patient under these circumstances has experi-
enced a sharp chill or an attack of urinary fever, who subsequently
to resting might have borne the use of instruments with impunity.

It is true that in the out-patient department of a hospital
it is not practicable to insist absolutely on every patient who
requires the catheter or a vesical exploration resting for a day
or two beforehand ; and it is fortunate that in the very urgent
cases, such as those of painful retention of urine, catheterisation
does not appear to excite urinary fever.   But it is often possible to
make some amount of preparation, by getting the bowels well
open by gentle saline purgatives, by regulating the diet, and
avoiding excessive exercise or fatigue, and perhaps by prescribing
a course of quinine, aconite, or arsenic for a few days or a
week.

The desire of house surgeons and young practitioners to
make a good diagnosis and discover an " interesting case " should
not lead them to explore the bladder of any patient hastily or
recklessly ; it is a light matter to them to introduce a sound,
but it may turn out to be a most serious one to the patient.
Rather let it be a rule of practice to prepare a patient just as
if he were about to undergo any other ordinary surgical operation.
Having decided that " catheter life " must be commenced, or a

sound introduced into the bladder for the purpose of diagnosis, the surgeon should insist on some such preparation as I have indicated, and if it can be continued for four or five days so much the better for the patient.

When any operation such as urethrotomy or lithotrity is to be undergone, still more necessary is previous preparation. In lithotrity the urethra might be educated for a day or two for the reception of the lithotrite by the daily introduction of soft and flexible instruments of increasing size, as was recommended by Civiale. This preliminary use of instruments is, however unnecessary now that an anæsthetic is invariably employed for litholapaxy as well as for other urethral operations. In all cases, no matter what the nature of the disease, the utmost gentleness in handling an instrument within the urinary passages is essential; force is never justifiable in introducing an instrument, and roughness when once it is within the bladder cannot be too strongly condemned.

That a certain amount of force is necessary, for example, in the use of the internal urethrotome and Holt's dilator, is quite certain; but this force is exercised under the controlling action of a guide or director, and is regulated to the requirements of the individual case. And although it is true that by the division of the stricture, and thereby the removal of the obstacle to the outflow of urine, the patient is freed from one of the causes of urinary fever, yet it must be confessed that, in spite of the advantages gained by them, these very operations are amongst the most frequent excitants of the fever in its most severe forms.

Force, when used upon the bladder, whether by sounding it roughly, or by distending it abruptly, is never free from danger, and it has been said by M. Guyon, though I cannot confirm the statement from my own experience, that the fever which results therefrom is proportionate to the violence inflicted.

An instrument which is to be tied in the urethra should not be sufficiently large to quite fill the canal or stretch the stricture. If the urine is in a very bad state it should be improved prior to an operation, when time permits; this is done by irrigating the bladder daily with Condy's fluid in warm water, boracic acid, salicylate of soda (grains 4 ad ℥j), acetate of lead (grain 1 ad ℥iv), or by one of the many other medicated solutions

usually recommended for the purpose. Cystamine and other anti-
septic drugs are sometimes beneficial. It is scarcely necessary to say
that every instrument the surgeon uses should be scrupulously
clean; in urinary operations this is a point of great importance.

In old men with prolonged partial retention, the urine should
be drawn off slowly, and always while the patient is in the re-
cumbent position and under circumstances which will ensure
rest, quietude, and an equable temperature for two or three
days after the first catheterisation. The object in these cases is to
favour the gradual and safe, and to avoid the sudden and dan-
gerous, change in the intrarenal pressure by the withdrawal of
long pent-up urine ; and unless the patient will consent to the
above precautions it is the surgeon's duty to decline to interfere.
In all cases it is desirable to protect the patient from exposure
to cold or fatigue after the use of either catheter, bougie, or
sound, as well as after any operation on the urinary organs.
The slightest chilliness afterwards, especially if followed by head-
ache, sickness, or scanty secretion of urine, should be at once
treated by confinement to bed, a dose of brandy or other diffusible
stimulant, restricted simple diet, warm drinks, and hot fomen-
tations to the loins and hypogastrium ; the vapour bath as a
means of inducing perspiration may be employed with benefit
in this stage as well as during the course of more pronounced
fever.

As soon as the initial rigor has occurred, and the fever sets
in, it becomes, if possible, even more necessary to keep the patient's
skin warm, and, indeed, to promote free perspiration. With
this object he should be covered with blankets, and the steam
or hot - air bath should be used. Hot tea, in large and
frequent draughts, is a favourite and useful beverage, and great
benefit is very often derived from the rapid and diffusible stimu-
lant effects of one good dose (say of an ounce or an ounce
and a half) of brandy or rum added to the tea, or taken in
hot water.

If there be diarrhœa, as there sometimes is, nothing need
be done to check it, especially if partial or complete suppression
of urine complicates the fever. Sweating and diarrhœa are the
two great means of eliminating that which the kidneys are failing
to remove from the blood. On more than one occasion I have

had reason to be satisfied with the result, when I have allowed diarrhœa to go on unchecked. The one precaution which is requisite, when diarrhœa occurs, is to take care that the patient incurs no chill while passing his stools, and to this end the bed-pan must be used and the body kept well covered during the proceeding.

Diet is a matter of the first importance, and those patients are fortunate who like and can digest milk. Milk is the appropriate and indeed the only fitting diet in urinary fever. Solid food of any kind is out of the question as long as fever deprives the mouth of saliva. Beef tea and the extracts of meat are unsuitable during the functional imperfection or inactivity of the kidneys. If there is a tendency to acid fermentation in the stomach or to sickness, lime-water should be added to the milk ; or Vichy water may be taken between the draughts of milk, or just after them. Milk and barley water in equal parts form a very useful drink. If sickness without diarrhœa exhausts the patient, enemata of milk and eggs with a little brandy should be given. Stimulants are sometimes needed throughout the attack, but except in a single dose at the onset, or after recurring rigors, they should be given with caution. When the bowels are costive, as they very often are, some saline aperient should be given as soon as the high temperature declines ; warm laxative enemata are also of the greatest service in urinary fever, as well as in all prostatic and vesical troubles. The medicines which enjoy most repute are quinine and tincture of aconite. I am in the habit of ordering five to ten grains of quinine in lemon juice, combined with half an ounce or an ounce of brandy, and half a drachm of liq. morphinæ hydrochl., every four or six hours, as long as the temperature keeps above 100°. Sometimes the second dose is given within two hours of the first if the rigor has been very severe and the temperature keeps very high. This treatment has been very satisfactory in my hands for the transient and recurrent paroxysmal forms of urinary fever, but it is useless and may be dangerous in cases in which there is suppression of urine.

Morphia, by increasing the action of the skin, relieves the congested blood-vessels of the kidneys. When there is suppression of urine in persons without organic renal disease, I have seen

most marked improvement follow the subcutaneous injection of $\frac{1}{120}$ gr. to $\frac{1}{80}$ gr. of atropine, with $\frac{1}{8}$ to $\frac{1}{4}$ gr. of morphia. One such injection of $\frac{1}{120}$ gr. of atropine with $\frac{1}{8}$ gr. of morphia has checked vomiting and induced sleep immediately; and four ounces of urine were excreted at the end of six hours after their use, though suppression had lasted for forty-three hours before the injection was given. The vomited matter in the case to which I refer contained (by Russell and West's test) 2·7 per cent. of urea, and as a large quantity of fluid was ejected, and the kidneys were perfectly healthy, the patient did not become comatose, and made a rapid recovery. If organic disease of the kidneys is present there is a fear of morphia inducing coma.

P. H. Watson's experience is in favour of quinine and digitalis given for some days before the first introduction of the catheter; and bromide of potassium or an opiate for twenty-four hours afterwards. He also strongly recommends the internal use of perchloride of iron throughout the whole period of the fever.

I have tried one-eighth of a grain of pilocarpin subcutaneously injected; it created a marked effect upon the skin by increasing perspiration, but its effect on the kidney is uncertain.

Gouley, of New York, and Harrison recommend for its diuretic action a teaspoonful of infusion of digitalis every hour or two; the action of this drug · upon the circulation requires, however, to be closely watched.

In the intermittent form of urinary fever, close attention to the digestive and excretory organs should be paid during the intervals between the paroxysms of fever. Regularity of the bowels; a bland diet, consisting of milk, milk pudding, fish, fowl, and cooked vegetables; warm clothing; and a mixture composed of mineral acids, and bark or quinine, are the lines of treatment to employ. With some persons a moderate allowance of claret or some light wine is beneficial. Tincture of iron through this form of fever is one of the most valuable remedies. When the joints are affected an application composed of iodide of potassium ʒij, glycerine ʒij, spts. vin. rect. ʒij, aquæ ℥vj, as recommended by Lund, should be painted over the affected joint, which should then be covered with a thick casing of cotton-wool, retained by an elastic bandage. If there be much effusion, and rest and remedies do not remove

the fluid, the aspirator should be used ; its employment should not be long delayed, as its timely and judicious use saves many joints from suppurating.   Rest in bed, with the application of splints to the affected limb, is absolutely requisite.   Recovery in these cases must not be looked for in less than ten to twelve or fifteen weeks.

In certain cases surgical treatment is indicated as a curative means.   Whenever there is any urethral discharge it must be checked by appropriate injections.   Urethral fistulæ should be healed, and if this is difficult or impossible, they must at least be kept as clean and free as possible from purulent or urinous secretions.   In my earlier work I recorded a case of stricture of urethra in which a disposition to urinary fever was cured by the use of Holt's dilator; and in another case therein mentioned, repeated attacks of fever occurred until internal urethrotomy was performed, and completely destroyed the febrile susceptibility. The effect of the operation in this respect was very striking. M. Guyon has observed similar results, and, with full knowledge of this fact, has even operated during the height of an acute paroxysm, with excellent result.*   He regards the tendency to urinary fever possessed by some patients with urethral stricture as one of the indications for urethrotomy.   Sir Henry Thompson, in his lectures at the Royal College of Surgeons, drew attention to the same thing.

In cases of imperfect, frequent, and painful micturition, whether due to stricture or to enlarged or inflamed prostate, in which there is a repetition of, or a tendency to, attacks of urinary fever, a cure may be effected by internal or external urethrotomy or the regulated evacuation of the bladder, according to the special requirements of the case.   It is not, however, often desirable to operate during a paroxysm of fever ; as a rule, the surgeon ought to wait for the complete subsidence of the attack before again interfering with the urinary passages.

* Guyon, " Les Maladies des Voies Urinaires," p. 569.

CHAPTER XIV.

RENAL AND CIRCUMRENAL FISTULA.

In this chapter will be described the fistulæ communicating with the kidney and renal pelvis. Those implicating the ureter are dealt with in the chapter on Ureteral Fistula (Vol. II.. p. 494). Reference will also be made to those cases of purulent fistula which occur in the perinephric tissue without communicating with the renal substance or cavity, and which occur after renal operations, and after perinephric suppuration, either from injury or disease.

Fistulæ communicating with the kidney or renal pelvis may be the direct result of disease, originating either in the kidney itself or in its perinephric tissue; or they may be the sequelæ of injuries or surgical operations.

These fistulæ may be classified (1) on an anatomical basis, according to whether the fistula arises from the renal or circumrenal tissue; (2) according to the nature of the fluid excreted, whether urine or pus, or a mixture of both; (3) according to the parts at which they establish an opening; (4) according to their causes; (5) according to their characters, as to whether they are simple or callous, or attended with loss of tissue.*

The method adopted in this chapter will be to describe the general characters, etiology, and treatment of all fistulæ which communicate with the kidney and pelvis of the kidney, or the perirenal tissue, and then to give an account of the various ways by which they open, either on to the external surface or into some of the internal viscera.

Etiology.—In a few cases of nephrotomy the operation has been performed with the intention of establishing a lumbar renal fistula (see chapter on Nephrotomy, Vol. II., p. 199).

The various forms of suppurative nephritis are among the most common antecedents of renal fistulæ. Tuberculous disease of the

* See J. A. Jagielski, " De Fistulis Urinariis Adjecta hujus Morbi Historia."

kidney is also a very pregnant cause of this troublesome condition; a fistula sometimes persisting even after the kidney has been removed.

Direct injuries to the kidneys which are not accompanied by suppuration are not generally followed by fistulæ, but exceptions frequently occur; and stabs, incised and lacerated wounds in the back and loins, are sometimes followed immediately, or after an interval, by discharge of urine. The records of military surgery contain many examples of fistulæ caused directly by gun-shot wounds of the kidney, or indirectly by the kidney becoming involved in the suppuration which follows gun-shot wounds of the loins. Nephrotomy for hydro-nephrosis and pyo-nephrosis is liable to be followed by a permanent fistula if the cause of obstruction is permanent, and the remnant of the kidney is not removed by nephrectomy. All traumatic renal fistulæ may be expected to close sooner or later.

Abscess of the kidney, whether due to the irritation of a renal calculus or to tuberculous or other form of renal disease, is not an unfrequent cause of urinary fistula in the loin, either by the abscess spontaneously bursting, or owing to the non-healing of the wound if the abscess has been opened by the surgeon. The discharge of pus and urine in such cases is often very obstinate, the wound contracting to a certain extent, and then remaining as a chronic, and sometimes even as a permanent, fistula.

The various causes of perinephric suppuration may indirectly lead to renal fistula if a communication is formed with the kidney, either before or after an opening has been established externally. After an operation in which the kidney has been incised, a fistula may end in a smooth-lined space, containing more or less pus, and surrounding one or other pole of the kidney, but without any communication whatever with the kidney or ureter. A fistula may have a communication with the renal cavity or ureter without there being any escape of urine through it; this can in some cases be demonstrated by the injection into the fistula of an aqueous solution of fuchsin. In not a few cases in which the ureter has been blocked, the kidney or its pelvis, as well as the circumrenal tissue, has suppurated, an abscess has opened on the surface, and a fistula has thus been formed.

McClelland, of Pittsburgh, records a case in which two fistulæ

formed as the result of obstruction of the ureter by calculi: the first opened in the loin, and gave exit to a calculus, and a sinus continued; four years afterwards a second abscess formed, and was opened in the groin, giving exit to pus and urine. As the excretory function of the kidney remained, the woman's state became very offensive, and she was successfully cured by lumbar nephrectomy.

In a case reported by Mr. Wright, a fistula in the groin followed nephrotomy for obstruction of the kidney by a calculus in the ureter. An abscess formed in the groin and was opened; three weeks later a calculus escaped through this opening, and a urinary fistula persisted.

Dr. Stephen H. Weekes and Dr. James McFaddon Gaston have published cases of fistula with discharge of calculi in the groin.

A primary cause of renal fistula, in a great number of cases, is a calculus in the pelvis of the kidney or in the ureter. A fistula of calculous origin may be either in communication with the kidney or ureter, or limited to the perinephric tissue.

Position of fistulous openings.—A fistula may open in one of several directions, namely, at the loin or groin, into the colon, duodenum, or stomach, into the pleural cavity or lung, or into the peritoneum.

Generally there is but a single opening into the cavity of the kidney or ureter, and that is upon the posterior aspect; but occasionally there are two or three, or even several openings on this surface of the organ.

It is much rarer for a fistula to open into the peritoneum than in any other direction; but in cases of ureteral obstruction, in which pyelitis has gone on to ulceration, this direction is sometimes taken, and death from acute peritonitis rapidly follows. Exceptionally, the escape of urine into the peritoneum is slow, and then a circumscribed collection, limited by adhesions, may be formed.

The right kidney, when the seat of abscess or pyo-nephrosis, may open either into the ascending colon or the duodenum, and when into the duodenum pus and urine may be detected in the vomited matter. Fistulæ of the left kidney more frequently open into the descending colon than do those of the right into either

ascending colon or duodenum. The kidney is often dilated before the fistula forms, and in some cases a pyo-nephrosis has attained a very large size before it gives way. In other cases a small renal abscess, or some minute suppurating point in a kidney the subject of pyelo-nephritis gives way, and is followed by suppuration in the circumrenal cellular tissue which in turn opens on the cutaneous surface, or into the bowel, lung, or pleura, and gives rise to a urinary fistula.

In a collection which I have made of unselected cases of fistula due to renal calculi, some of the fistulæ followed the bursting of pyo-nephrotic kidneys; and others were the result of perinephritic suppuration and the bursting of the extra-renal abscess. Some opened spontaneously into the lung; others into the stomach, duodenum, or colon; one into the colon and lung, and as both of these organs communicated with the renal pelvis it thus happened that the lung communicated with the colon.* Of those which opened on the external surface one did so below the trochanter, one between the eighth and ninth ribs, one or two in the groin, but the majority in the loin.

When a perinephric abscess burrows beneath the ribs and points posteriorly in an intercostal space, the course taken by the pus is through the costo-diaphragmatic hiatus (Fig. 6, p. 11). This hiatus, formed by the absence of the muscular fibres of the diaphragm, exists on both sides of the trunk, and gives facility for the ascent of pus between the liver and peritoneum, or spleen and peritoneum in front, and the ribs and intercostal muscles behind.

Nature of the fluid which escapes.—The fluid which escapes from a renal fistula is sometimes pus, sometimes pus and urine, sometimes urine alone. It depends upon the condition of the kidney which is involved in the fistula; if the organ has been converted into a tuberculous abscess cavity, then pus escapes; if a pyo-nephrosis from obstruction in the ureter has been the cause, then pus and urine; if a wound of the kidney, either surgical or accidental, or a ruptured or nephrotomised hydronephrotic cyst has given rise to the fistula, then urine, sometimes many ounces in the day, will be discharged.

The urinous character of the fluid is recognised in some cases by its odour, in others by the deposit of phosphates about the

* *See* Specimen No. 2351A, in St. Bartholomew's Hospital Museum.

orifice of the fistula, or by detecting the presence of urea, uric acid, or the urates in the fluid either by chemical reaction or microscopical examination. Sometimes there is much excoriation about the external orifice of the fistula; or a number of unhealthy granulations surround it.

Relative frequency of fistula, after operations on the kidney. —A good idea of the proportion of cases of fistulæ which follow operations on the kidney and their relative importance in connection with the surgery of this region may be gathered from the following statistics, which are taken from the 276 operations of all kinds on the kidney which I had performed up to the first week in March, 1898.*

Of these 276 operations three were nephrectomies performed on account of fistulæ the direct results of previous operations on the kidney—the fistulæ having followed a nephrotomy, a nephropexy, and the opening of an abscess of the kidney respectively. In a fourth case nephrectomy was performed on the eleventh day after an exploratory incision on account of recurrent secondary hæmorrhage from the kidney. Deducting these four cases and eight others in which an operation was performed for calculous anuria, we find that of the remaining 264 cases operated upon for various causes, thirty-five did not live long enough to enable any conclusions to be drawn from them, while of the rest (229) there was a fistula during recovery in thirty-two. The numbers are as below.

Nephrolithotomy	33 operations.	Fistula in 5 cases.	
Nephrotomy for Calculus	32 ,,	,,	10 ,,
Nephrectomy for Calculus	12 ,,	,,	2 ,,
Nephrectomy for Acute Suppuration .	1 ,,	,,	0 ,,
Exploration of Kidney	42 ,,	,,	1 ,,
Operations for Nephropexy . . .	57 ,,	,,	7 ,,
Operations for Hydro-nephrosis and Pyo-nephrosis	16 ,,	,,	2 ,,
Operations upon Tuberculous Kidneys .	21 ,,	,,	3 ,,
Operations upon Tumours of Kidney .	11 ,,	,,	0 ,,
Operations for Injury of Kidney . .	4 ,,	,,	2 ,,
	229		32

The proportion of renal fistulæ in the cases of nephrolithotomy

* These cases are fully tabulated in "The Origin and Progress of Renal Surgery" (Hunterian Lectures, 1898).

was not nearly so high as it appears, for in one of the cases a
fistula was purposely kept open on account of acute symptoms
which arose whenever the wound commenced to close ; and of
the other four, two only were of urinary character, the others
being merely superficial.   The fistulæ which followed nephro
pexy were not urinous, and did not communicate with the kidney
cavity.   Of the total of thirty-two cases, which includes all varie-
ties, whether superficial or deep, of long or short duration, fifteen
are known to have closed, and most of them within a short time ;
three more are noted as closing when last seen, and one other
closed, but broke down again on the formation of a fresh abscess.
Three only are recorded as permanent, and these include the one
purposely kept open which is mentioned above.   There is no
history of the ultimate result of the remaining ten cases, but
there is no reason to suppose that the majority of them did not close.

In 128 cases which during the years 1884–1894 were collected
by me from British and American literature of operations for
renal calculi followed by recovery, there were nine cases of fistula.

Though the possibility of a fistula forming need not be con-
sidered a serious argument against renal operations, yet it must
be borne in mind that in any individual case the chances of a
troublesome or permanent fistula are much greater if there is
suppuration or much disorganisation of kidney substance present,
and this is one important reason, among many others which
are pointed out elsewhere, for recommending early operations for
renal calculus, instead of delaying till the case has become compli-
cated by a pyo-nephrosis, as is too often the case.

The part which foreign bodies may play in preventing the
closure of wounds is well exemplified by the temporary fistulæ
which follow nephropexy ; the final closure of these wounds
is sometimes delayed, or after healing by primary intention
the wound at some point may break open, owing to the irrita-
tion kept up by a suture, and when this has been discharged
the sinus usually rapidly heals.

Fistulæ which follow operations are much less serious than
those which occur spontaneously after perinephric suppuration.
It is after nephrotomy for calculous and tuberculous pyo-nephrosis
that fistula is especially apt to follow operation ; and these fistulæ are
specially intractable if there has been much perinephritis present.

To avoid infection of the perinephric tissue after nephrotomy for pyo-nephrosis, it is often advisable to suture the cut edges of the kidney to the margins of the external wound.

Renal Fistulæ which Open on the Cutaneous Surface.

Renal fistulæ which open in the loin may follow operations upon the kidney, and may be due to any of the causes named above : calculus, wounds, various forms of external violence, parasites, foreign bodies, tuberculosis, or sloughing of the kidney or its pelvis after distension of the cavity of the organ. La Peyre* related a case in which a fistulous opening communicated with the right kidney. The kidney was transformed almost into a fatty mass, and contained three worms three and a half inches long ; three other worms were embedded in the neighbouring muscles, and there was caries of the spine near the pillars of the diaphragm.

Traumatic fistulæ are more easily cured than those which follow disease, or result from the incision and drainage of a renal abscess. There are very few traumatic renal fistulæ which are not closed sooner or later, and generally within a short time. The history of the American War of the Rebellion has proved this. So also has the operation of nephrolithotomy. When a foreign body is impacted in the fistulous track, or within the pelvis of the kidney or the ureter, the fistula may remain open for a very long time, but will usually close immediately or shortly after the escape or removal of the foreign body.

Diagnosis.—There is but little difficulty in diagnosing a lumbar renal fistula from the clinical history and the course of the disease, and from the urinous or urino-purulent characters of the fluid which escapes from the opening ; but in any case of uncertainty as to whether the discharge contains urine or not, the diagnosis may be further strengthened by giving the patient methylene blue or iodide of potassium internally, and then finding the drug in the fluid ; or fuchsin may be injected into the fistula, and if the latter communicates with the kidney the colouring will rapidly make its appearance in the urine.

When a fluid having a urinous odour, or containing urea, uric acid, or urates, issues from a fistula which followed upon

* *Journ. de Médecine*, tome lxv., p. 375 (1785).

an attack of nephritis, pyo-nephrosis, hydro-nephrosis, or injury to the kidney, there is no room for doubt. It must be borne in mind, however, that urinary fistulæ in the loin are some-times the consequences of disease in the lower urinary passages, and communicate with the ureter, bladder, or even the urethra, but not at all with the kidney. A remarkable case of this sort was published by Desault.* There were several fistulæ, some in each loin, following a blow from the fist on the scrotum ; and though the patient recovered after a long illness, Desault appears to have had no doubt that these fistulæ opened internally, either into the bladder or the urethra.

A remarkable case of renal lumbar fistula is related in the chapter on perinephric abscess. (*see* p. 288 and Fig. 35).

There are many cases on record of urinary fistulæ communi-cating with the kidney and opening externally in the loin or the groin, through which calculi have been discharged spon-taneously or removed by the surgeon.

The appearance of the cutaneous orifice of a fistula varies con-siderably according to the cause and length of time the condition has existed. In cases which depend upon tuberculous infection the opening is often patulous and its edges are covered with coarse granulations ; while in other septic conditions the opening may be actually retracted and inclined to be funnel-shaped.

The walls of the fistula in long-standing cases are much thickened, and contain an excess of fibrous tissue which prevents healing. The fistulous track frequently communicates directly with the kidney, but it may also burrow in the circumrenal tissue as well, and if it has arisen primarily from a circumrenal abscess its communication with the kidney may be very indirect.

The opening into the kidney varies with the cause of the fistula—from a small shallow depression to an aperture of large size. In cases of advanced pyo-nephrosis the whole of the interior of the kidney may communicate with the fistula.

The condition of the ureter is of course important; it is usually affected, to some degree, in cases which arise from sup-puration within the kidney; thickening of its walls with partial obliteration of its lumen being one of the most constant lesions found.

* " Œuvres Chirurg.," tome iii., p. 301 (3rd ed., 1813).

RENAL FISTULÆ OPENING INTO THE STOMACH.

A very rare form of fistula between the left kidney and the stomach has been described. Pus, urine, and urinary calculi are said to have been vomited. Such a case is recorded in the *Philosophical Transactions* (1678, No. 3), wherein a woman, aged twenty-one, after violent nephritic pains and retention of urine, vomited a quantity of coffee-coloured gravel weighing half an ounce, and subsequently passed gravel and small stones by the mouth, rectum, and urethra. Another and very similar case, also in a young woman, is recorded in the *Journal de Médecine.** After an attack of nephritic colic and retention of urine, a calculus was detected by the catheter in the neck of the bladder and was extracted by forceps; on several occasions subsequently, after similar attacks of renal colic, large numbers of small and medium-sized stones were cast up, and others were voided at the anus. Lazarus Riverius † and Fernelius ‡ have recorded cases of the sort. Fernelius's observations also include cases of rupture of the kidney, and of sacculated and suppurating kidneys opening into the duodenum, the stomach, and large intestine.

There is a considerable degree of uncertainty as to the genuineness of the symptoms and accuracy of diagnosis in these cases of gastro-renal fistula. Rayer said he knew of no well-authenticated case of such a fistula. In an instance related by him the patient was at length proved beyond doubt to have been an impostor, though Rayer admits that for the time he was completely duped by her. A single woman, aged thirty-six years, was admitted into La Charité Hospital in July, 1836. Nine months previously she had fallen from a height of six feet, and five days after the fall she passed blood in her urine and from the anus, and vomited blood. The hæmorrhages continued for four or five months, retention of urine followed, a tumour formed in the right kidney, the urine became purulent, and on the 4th of October, after seven days of suppression of urine, diarrhœa, bloody stools, and fever, it was stated that the matter vomited tasted, smelt, and gave the reaction of urine. The tumour in the flank con-

---

* Tome xvii., p. 173.
† " Observationes Medicæ et Curationes Insignes " (1646).
‡ " Universa Medicina Pathologia," lib. vi.

siderably diminished in size, and it really seemed that there had
been a veritable discharge of urine by the mouth. It was
discovered, however, that the matter said to have been vomited
was a composition of urine and particles of food, ingeniously
blended by the patient whilst she reclined over the edge of the
bed pretending to be vomiting.* Nysten has recorded two
cases, both in women, in which urine was proved to exist in
the matter said to have been vomited. One of the two women
was clearly an impostor. The other was, so Nysten supposed,
genuine and above suspicion.

In the following case of *gastro-renal fistula* the nature of the
fistula was verified by post-mortem examination.

A coachman, aged twenty-six, was admitted, under my care,
into the Middlesex Hospital, on November 1st, 1884, with the
following history. Eleven months before he had an attack of
" inflammation of the bladder," and passed pus both with his
urine and motions. Five months afterwards he first felt tender-
ness, and noticed a swelling in the left loin. Six weeks later
this swelling was " larger than his fist," and burst, discharging
more than a pint of pus. Four small fistulous openings, one
over the last rib in the vertebral groove, and three over the
left sacro-iliac region, had since been discharging pus freely.
He had been progressively declining in health. On admission
he was fairly nourished, but pale and looking ill. All the four
sinuses in the back were discharging pus. On exploring the
upper opening with a probe, it was found to extend vertically
upwards parallel with the spinous processes, further than the
length of the probe ; outwards, the probe could be passed for
half its length ; and downwards it could be made to emerge
at each of the openings. It was thus evident that there was
a wide separation between the integuments and the superficial
surface of the sheath of the erector spinæ muscle. Careful per-
cussion and palpation of the abdomen, and an examination of
the chest, disclosed nothing. No diseased bone had been known
to exist, and no caries could be felt. The sacro-iliac joint was
not diseased. Pelvic cellulitis and circumrenal abscess were
considered, but the physical signs of neither could be made
out. There was, however, the history of " inflammation of the

* Nysten, " Rech. de Physiol. et de Chimie Pathol.," p. 280.

bladder," and of "pus in the motions," as well as in the urine. The urine, on examination after his admission to the hospital, was found to be of an amber colour, flocculent, faintly acid, of specific gravity 1025, containing phosphates, but no free albumen, and pus cells were seen under the microscope. On November 5th an anæsthetic was given, and two incisions were made, one over the twelfth rib and the other nearly vertically through the upper fistulous opening. A sinus, large enough to admit a probe, led from the subcutaneous space thus laid open down to the twelfth rib. The rib was not diseased; the probe was prevented from passing farther inwards by it. The surfaces of the old abscess walls were scraped, and a drainage tube was inserted. The anæsthesia lasted about fifteen minutes. The patient had a good night, and was as well as usual the next morning; but at midday, November 6th, he could not take his food, and was sick, and at 1.20 p.m. he was seized with a rigor which lasted twenty minutes. All the afternoon and evening the temperature continued high, varying from 102·6° to 103·8°. During the evening his bowels were moved six times, the motions being very offensive, and of pea-soup consistence and colour. At 10 p.m., November 6th, complete anuria was established. The pulse was small, rapid, and felt with difficulty; hands and feet cold; fingers and lips of a bluish hue. He was very restless, and apprehensive of death; not quite coherent in speech, but asserting positively, in answer to questions put to him, that he had no pain. The abdomen and chest were again examined, but no disease detected. A catheter was introduced into the bladder, but no urine was withdrawn. On removing the catheter, about a tea-spoonful of thick and offensive pus ran from it. I next examined the rectum and found it distended with air and a quantity of liquid, and on stretching open the anus there was a free flow, continuing for several seconds, of most offensive pus. It was now no longer doubtful that there was an abscess, involving the kidney, communicating with the sinuses in the back, and opening into the intestinal tract. The man died at 1 a.m. the same night. At the post-mortem examination the left kidney was found embedded in a thick layer of circumrenal cellulo-fatty tissue, from one and a half to two

inches thick. This was firmly adherent to the fibrous capsule of the kidney. On subsequently laying open the kidney, it was seen to be considerably enlarged and riddled by abscesses, which had dilated the calyces and hollowed out the pyramids. Opening into one of the caseous and suppurating cavities of the kidney at the upper and back part of the organ was a fistulous track, which, by its other extremity, opened into the old superficial abscess space in the loin. By another fistulous track, filled with yellow pus and of the diameter of a crowquill, the left kidney communicated with the left margin of the greater curvature of the stomach. The spleen, as well as the stomach, was closely adherent to the renal mass. The small intestines were not adherent at any point ; the descending colon passed over the anterior surface of the kidney mass, but it, together with its mesentery, was freely movable upon the kidney. The colon and rectum contained milky-looking pus, but no communication existed between the bowel and the kidney. A most careful examination of the whole length of the gastro-intestinal tract proved that the only communication which existed between it and the kidney was that at the left end of the great curvature of the stomach. Through this, therefore, the pus which was found in as well as that which had been passed off by the bowel must have entered. The right kidney was large, its capsule non-adherent, and its surface smooth and pale. On section the cortex was swollen and very pale, and the pyramids were partly obliterated by the swelling of the inter-pyramidal portions. The whole of the medullary portions were very pale. There was a recent thrombus in one of the large branches of the renal vein (see Fig. 34, p. 272).

Dr. J. R. Chadwick * brought a case of gastro-nephric fistula before the notice of the Obstetrical Society of Boston. In this case solid particles of food were withdrawn from the bladder through a catheter. The most careful investigation, however, is requisite before accepting this as a symptom of a gastro-renal or intestino-renal fistula. In a lady whom I saw several times in consultation such a fistula was supposed to exist ; but the explanation of the presence of food particles in the urine was subsequently proved to be a communication between the bowel

* *Obstetric Gazette*, Cincinnati.

and the bladder above a carcinomatous stricture of the bowel, for which colotomy had ultimately to be performed.

RENAL FISTULÆ OPENING INTO THE DUODENUM.

Fistulous communications between the right kidney and the duodenum, though very rare indeed, have been proved to exist. Campaignac supplied Rayer with full notes of such a case, which Rayer has illustrated in his atlas.*   The patient was a tailoress, aged forty-five, who had a tumour in the right flank and lumbar region, formed by the distension of the right kidney.   At the post-mortem examination it was proved that this tumour, then much collapsed, communicated with the second part of the duodenum by means of a small brownish opening.   Two other small fistulous openings, an inch higher than the first, communicated with a pouch scooped out as it were at the expense of the right kidney and liver.   Some days before death vomiting set in at the time that the tense tumour began to subside.   The vomited matter was bitter and of an acrid odour resembling stale urine.

Diagnosis.—It is possible that some of the cases which have been supposed to be gastro-renal fistula have really been duodeno-renal; and this may have been the case even where renal calculi, as well as urine, have been vomited.

If a tumour of the right flank associated with renal colic and the presence of pus or blood in the urine, or other symptoms suggestive of renal disease, diminishes or completely subsides after the patient has vomited, and especially if the vomited matter has the taste, odour and reaction of urine, a gastro- or duodeno-renal fistula would naturally be suspected.   If the tumour was of the right side, the duodenum in all probability would be the point of communication with the right kidney; if of the left flank, the stomach would probably be in communication with the left kidney.   Rayer's and Nysten's cases, referred to above, ought, however, to place us on our guard against too readily accepting the diagnosis of gastro-renal fistula, even in cases in which the existence of a renal tumour renders such a fistula not improbable.

RENAL FISTULÆ OPENING INTO OTHER PARTS OF THE INTESTINES.

A renal fistula may communicate with almost any portion of the intestine, large or small; but those which open into the

* Plate XX., Fig. 1.

colon are by far the least uncommon. Instances of renal abscess opening into the large intestine have been recorded from very ancient times. Rayer, with the remarkable industry with which he worked up the history of the literature of almost all the diseases of the kidney, gives extracts from several ancient as well as modern authors who have described such cases. He also himself reports a case of tuberculous abscess of the left kidney which communicated with the colon.

In a case recorded by Annandale * a communication with the colon on the right side formed on the fifteenth day after a lumbar abscess arising from renal calculus had been opened and the stone removed ; fæcal matter escaped by the sinus till the twenty-fourth day after the operation, the patient finally making a good recovery.

Dr. John Ogle has also related the case of a patient, aged thirty-one,† in whom a perinephritic abscess on the right side burst into the colon and discharged calculi through the intestinal tract.

Diagnosis. — When a communication exists between the large intestine and an abscess of the kidney, a pyo-nephrotic cyst, or a perinephric abscess connected or not with the cavity of the kidney, the subsidence or complete disappearance of the tumour in the flank will be followed by the discharge of pus, or urine and pus with the stools. The presence of urine or pus in the stools will be very soon disclosed when the abscess communicates with the descending colon. In the case of a gastro-renal fistula related above I found pus in the rectum some hours before death, but I cannot say how long after the establish-ment of the opening into the stomach. The fistula had certainly existed a long time ; and the man had passed pus by the rectum eleven months before I saw him. Sometimes the fæces have been noticed to have a urinous odour ; but when the whole of the renal substance has been destroyed, and the kidney has been converted into a mere pus cavity, there will be no trace of urine mixed with the pus discharged through the fistula.

Between an abscess of the kidney or a pyo-nephrosis which has discharged into the descending colon on the one hand, and the escape of purulent urine into the rectum through a recto-vesical fistula on the other hand, it might be difficult to diagnose,

* *Edin. Med. Journ.*, April, 1893.
† *St. George's Hospital Reports*, 1867, p. 373.

if the rectal orifice of the fistula was high up out of reach of the finger. The clinical history of the case would, however, help materially towards a correct opinion, and if gas or fæcal matter was passed by the urethra, as well as purulent urine by the anus, the probability would be greatly in favour of a recto-vesical fistula. Fæces and intestinal gas might, though less probably, be discharged through the urethra after gaining entrance to the urinary passages through an intestino-renal or ureteral fistula.

The prognosis of the gastro- and intestino-renal fistulæ is very unfavourable; death generally ensues at an earlier or later period from acute inflammation of the bowel, colliquative diarrhœa, or prolonged suppuration. Cruveilhier * has put on record the case of a woman who died of hectic fever, the cause of which he was unable to discover during life; but on opening the body he found the two kidneys united and situated in the true pelvis behind the rectum. This double kidney contained a large quantity of pus and had burst into the rectum. In other cases recto-renal fistulæ arise through the formation of a secondary perinephric abscess, the pus from which burrows and bursts into the rectum

Renal Fistulæ Opening into the Lung.

These are very rare. Rayer could only find four cases. Three were of the left kidney, and one of the right. An interesting case was that of a locksmith, aged thirty-nine, who was admitted into La Charité in May, 1839. Eighteen years before he had been operated upon for vesical calculus. Eleven years after his recovery from this operation he suffered pains in the region of the left kidney, and passed purulent urine. These symptoms, however, disappeared, and seven months before his admission into hospital very acute pains again affected the left renal region, and extended along the course of the left ureter. The urine was loaded with pus. Abundant purulent expectoration occurred suddenly on two occasions, and was each time followed by a marked diminution of pus in the urine. Death took place on the 18th of June, and at the post-mortem a communication was found between the bronchi of the left lung and the left kidney, at the upper part of which a small perforation existed which opened through a dilated calyx into the renal pelvis. The

* " Anatomie Descriptive," tome ii.. p. 694.

fistulous track penetrated the diaphragm at the edge of the left branch of the central aponeurosis, and was surrounded by dense fibrous adhesions, connecting together the posterior surface of the stomach, the spleen, and the upper part of the kidney. The kidney substance was atrophied, and the calyces and pelvis were dilated, and filled with a large branched calculus. A calculus and some pus occupied the fistulous passage between the lung and renal pelvis.

In a case recorded by Marcet* of a man, aged twenty-seven, an abscess following a traumatic pyelitis opened into the colon and also communicated with the right lung. There was also in this case a large stone in the pelvis of the kidney. A specimen of a very similar condition is that already referred to, which is in the museum of St. Bartholomew's Hospital (see p. 377).

In another instance† a female of twenty-four suffered from pyuria with septic fever, followed later by symptoms of pulmonary abscess. A fatal termination ensued, and the post-mortem examination revealed a large calculus in the substance of the right kidney and another in its pelvis. Both the kidney and its pelvis were distended with pus, which formed a layer under the renal capsule separating it from the parenchyma. From this region the pus had burrowed upwards behind the liver and had formed an abscess beneath the under surface of the diaphragm. There was a corresponding collection of pus on the upper surface of the diaphragm, but no actual perforation of the muscle had taken place, and there was another large abscess in the adjacent part of the right lung.

Prognosis.—The termination of reno-pulmonary fistulæ is death from septicæmia, or from dyspnœa and exhaustion due to incessant cough and the expectoration of large quantities of pus. The renal abscess may open (1) at once into the lung, the renal tumour having enlarged until it is in contact with the under surface of the diaphragm, and the lung itself having become adherent to the upper surface of this muscle; (2) a long sinuous track, surrounded by adhesions, may extend between the kidney and lung; or (3) a sub-diaphragmatic abscess may have formed, and ultimately have broken into the lung. Sometimes

---

* *Bull. de la Soc. Anat.*, tome xxviii.

† *Dublin Med. Press*, 1865, 2nd series, xi., p. 562.

the lower lobe only of the lung is involved, and this only to the
extent of some inflammatory thickening around the sinus; or a
small abscess may have formed in the base of the lung; in other
instances the whole lung is more or less involved, and one or
more entire lobes may be transformed into a large abscess.

Renal Fistulæ which Open into the Peritoneum.

In cases where septic urine, or urine and pus, have been ex-
travasated into the peritoneum, death is, as a rule, so rapid that
nothing can be done in the way of treatment. Sometimes the
patient dies within twenty-four or thirty-six hours after the
extravasation commences; rarely is life prolonged beyond a few
days. When, however, as in rare cases of calculous pyelitis,
the peritonitis is localised and inflammatory adhesions have formed
around the kidney, the urine is effused very slowly into the
circumscribed space, the symptoms are chronic, a localised abscess
is formed, and a favourable termination may occasionally be
obtained by incision and drainage.

Treatment of Renal and Circumrenal Fistulæ.—In consider-
ing the treatment of every case of renal or circumrenal fistula,
the first question which has to be decided is whether the kidney
itself is involved or not. If the kidney is involved, it becomes
necessary to decide whether the ureter is pervious, or partially
or entirely obstructed, or in a diseased condition without being
obstructed. Finally, if after the failure of other treatment
nephrectomy is contemplated, it becomes a matter of the first
importance to ascertain the condition of the opposite kidney.

When urine, or urine and pus, escape from the fistula, there
is no doubt as to there being a connection with the kidney or
its duct. The rare cases in which a lumbar fistula with the
escape of a urinous fluid has followed extravasation of urine
from the urethra or bladder are diagnosable by their history.

When the discharge consists only of pus it is very difficult
in many cases, even when the fistula is a sequel of nephrotomy,
to determine whether it is renal or perirenal; and still more so
is it when the fistula has followed the bursting or opening of
a perinephric abscess. In some instances of spontaneous fistula,
the history will help to decide whether the original mischief

was renal, ureteral, spinal, or osseous, or was due to some other extra-renal cause. But occasionally the diagnosis will not be cleared up in spite of careful analysis of the urine, and the injection of coloured fluids into the fistula, until the fistulous track or tracks are freely laid open, and followed to their source in the kidney or otherwise.

In all cases the parts around the fistulous orifice must be kept clean and free from irritation and from the contact of discharges. Time should be allowed for the spontaneous closure of the fistula, and in many instances the surgeon will not be disappointed.

If, however, the fistula persists, caustics, the cautery, or a free incision must be tried, so as to lay open any sinuous track, vivify or excise callous surfaces, and remove spongy granulations or calculous deposits.

The injection of iodine or mercuric solution, besides acting as a disinfectant, will sometimes stimulate the sinus to healthy action. If a foreign body, such as a bullet, a piece of bone or clothing, or a calculus, is keeping up irritation and preventing healing, it should be removed.

When pus has burrowed far in the surrounding tissue, the extremity of the fistula may be a long way from the kidney as well as from the external orifice ; and it may be necessary to make very extensive incisions through the lumbo-ilio-inguinal regions, or to remove portions of one or several ribs. I have thus had to track circumrenal fistulæ below the brim of the bony pelvis, and to remove portions of several of the ribs. I have (" Hunterian Lectures," p. 84) reported a most successful case in which I removed from a gentleman, after a long and severe illness from calculous pyo-nephrosis which had been allowed to burst into the perinephric tissues, portions of the last four ribs, scraped out sinuses, and extracted several fragments of calculus from the cellular tissue high up above the kidney. The patient made an excellent recovery, and remains well at the present time without having had his kidney excised.

In uro-purulent, as well as in purulent fistulæ, an effort should be made to stop infection by antiseptic injections and suitable drugs. If the suppurative process can be cured the fistula, if it has been kept up by pyelitis and obstruction due to ureteritis, may in time close without any surgical intervention. In renal

fistula the treatment will, in the first place, often largely depend upon the state of the ureter. In two or three cases of partial obstruction of the ureter catheterisation of the ureter, or the retention of a ureteral catheter for many days, is said to have been followed by some success; but later information would probably show that the stricture or stenosis of the ureter had relapsed; and in one case the fistula is stated not to have closed. There is little hope of permanently re-establishing the patency of the ureter by the *cathéter en demeure*, and the catheter is apt to excite a great deal of irritation, and is not free from risks both of a local and constitutional character.

The most satisfactory and most permanently successful proceeding is to cut down upon the kidney and remove the obstruction, whether by ureterotomy for valve stricture or calculus, or by a plastic operation on the renal pelvis in the manner described in the chapters on these subjects.

In two or three cases of urinary or uro-purulent fistula in my practice, success has followed the operation of excising the fistulous track in the kidney, and suturing the cut surfaces of the parenchyma just as after an ordinary nephrotomy. In these cases the callous tissues between the kidney and the cutaneous surface have also been cut out. If the ureter is completely impermeable, it may be possible to re-establish the channel by cutting out the affected piece of ureter and uniting the ends by a uretero-ureteral graft; or, if the obstruction is near enough to the bladder, by a uretero-vesical graft. An impacted calculus can be removed from any portion of the ureter in either sex. If it is quite impossible to re-establish the patency of the urine channel and the other kidney be sound, the best treatment for a permanent fistula communicating with a diseased organ is nephrectomy. This operation should be practised in any case in which, all other treatment having failed, the life of the patient is threatened or his comfort sacrificed, provided the opposite kidney is in good functional order. It should, however, be borne in mind that persons may live in excellent health and for many years with a lumbar fistula which discharges urine freely: and also that although for a long time urine may have been escaping from a fistula, the quantity of urine discharged may become less and less, or the flow may even cease altogether.

A patient upon whom I operated in December, 1883, for hydro-nephrosis attended with agonising pain, and due to impacted calculus, or stenosis of the ureter after calculus, is alive, very active and very well to this day—seventeen years after the operation.   His affected kidney discharges daily through the loin fistula many ounces of practically normal urine, and this is collected in a convenient apparatus adjusted over the opening and retained by a belt round the waist.   This gentleman has repeatedly refused offers of surgical treatment to close the fistula, and continues to discharge his duties as a clerk in a Government office.   The case was fully reported in my earlier work on " Surgical Diseases of the Kidney" (1885), p. 312 *et seq*.

If a purulent fistula persists after nephrectomy has been per-formed, and resists all simpler treatment, it will probably be due to a continuance of ureteritis or peri-ureteritis or both; and if so it will be requisite to excise the whole of the ureter (*see* the chapter on Ureteral Fistula, Vol. II., p. 494).

In most cases a renal or ureteral fistula, of calculous origin, will I believe close permanently after nephrectomy, even if a stone be left impacted in the ureter at the time of the operation. But should it not do so, it may be necessary, as in the case of fistulæ kept up by tuberculous ureteritis, to perform partial or complete ureterectomy. If the lower end of the ureter be blocked and the tube above the obstruction is suppurating, the cellular tissue of the loin is very likely to become septic after the excision of the kidney even if the upper end of the ureter is ligatured at the time of the operation, and it is almost sure to do so if the end is not ligatured.   In a lady whose right kidney I removed for calculous pyo-nephrosis (the calculus weigh-ing $6\frac{1}{4}$ ounces), the wound, after completely healing, subsequently suppurated profusely, and continued to do so until after I had removed the ureter quite down to the bladder, together with nine fair-sized calculi which were impacted in the ureter. This ureter-ectomy was performed by the sacral route.

A urinary fistula, due to obstruction in the ureter, may in time cease to discharge urine owing to complete atrophy of the kidney.   The length of time required for this to be ac-complished depends on the degree of obstruction which the fistula on the one hand, and the ureteral block on the other, offer

to the escape of urine. The more complete the obstruction, the more rapid the atrophy, and *vice versâ*. In a case of my own the process took seven years (*see* Vol. II., pp. 348, 349, of this work). Even after a fistula ceases to be urinous, it may persist as a suppurating sinus.

The closure of the fistula by surgical treatment is often tedious, and sometimes impossible ; and in some cases in which it has been successfully accomplished, the fistula, after remaining closed for many months, or a year or two, will reopen.

The treatment of renal and circumrenal fistulæ which open into a viscus or visceral cavity must depend upon the conditions and connections of the particular case. The fistulous opening may be left to close naturally if it communicates with a bronchus, the stomach, or the bowel, if the patient's strength is not becoming exhausted by the irritation and discharge, and if neither the lung in one case nor the renal or circumrenal abscess in the other is threatening to become actively infective. Lumbar nephrotomy and drainage may succeed in curing the visceral fistula, and afterwards the lumbar opening may be allowed to close.

If after a trial of this treatment a cure is not in prospect and the patient's general condition and the state of the opposite kidney render it advisable, nephrectomy ought to be performed. Any obstruction to the course of the natural flow of urine ought in these cases as well as in the external fistulæ to be removed.

There is no doubt that many cases of spontaneous fistula (as distinct from fistula following surgical operations) might have been entirely prevented had proper surgical treatment been resorted to in good time.

CHAPTER XV.

NEPHRECTASIS, OR RENAL DISTENSION.

In considering the causes and mode of development of renal distension it will be convenient for the moment to disregard the distinction between hydro- and pyo-nephrosis; the septic infection, whether primary or secondary, having no particular influence on the process, which is mainly one of hydrostatic pressure and unequal extensibility of the limiting structure of the kidney. The distending force is supplied by the continuous secretion of urine behind an obstruction in the urinary passages, which obstruction is either incomplete, intermittent, or of gradual development, for it has been demonstrated both by observation and experiment that a sudden complete stoppage of the outflow of urine leads to rapid atrophy and ultimate disappearance of the affected kidney.

Guyon showed (*Ann. des Mal. des Organ. Génito-urinaires*, 1892) by experiments upon dogs the different effects which partial and complete obstruction of the ureter produced upon the corresponding kidneys, effects which in the human subject clinical and post-mortem observation had already taught us. Partial obstruction gave rise to hydro-nephrosis, while a complete obstruction was followed by renal atrophy after a slight temporary distension.

Robinson of Chicago (*Ann. of Surg.*, vol. xvii., 1893) performed similar experiments, and his results show that a ureter may sometimes be occluded for several weeks without producing any special harm, and that the kidney may resume its natural functions after the obstruction has been removed. In support of this view, Robinson quotes the case of a lady in whom the ureter of one side was ligatured for six weeks, and when at the end of that time the ligature was removed the kidney resumed its functions as before.

Experiments upon this important question have more recently been made in this country by J. Rose Bradford (*Trans. Path. Soc.*, 1897) upon dogs. The ureter was ligatured in two places near the bladder and divided between. After an interval of

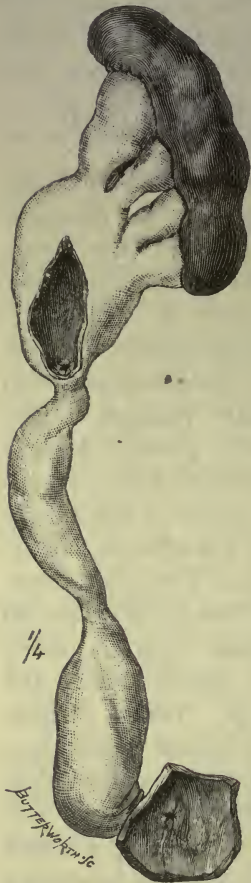from ten to forty days, the distended ureter was exposed, sutured to the skin of the abdominal wall and drained, 50 to 70 cc. of urine being evacuated. The fluid was clear in nine cases and purulent in three. The animals were killed at periods varying from seven to fifty days later, and on examining the kidneys they were found to have resumed their normal shape, but were only one-third or one-fourth their normal size. There was very little change to be seen by the naked eye, and microscopically there was no cirrhosis found. Some of the tubules had disappeared, and in others the epithelium had in part been shed; but the main cause of the atrophy was the crowding together of the tubules, and more especially the small size of the cells lining them. These cells had lost all their granules, their protoplasm being clear and glass-like; the nuclei stained well. The appearances were those of "resting cells."

Fig. 45.—Unilateral Hydronephrosis associated with great but irregular dilatation of the Ureter, and not causing Tumour. Removed after death; no cause detected on post-mortem examination. (Middlesex Hospital Museum.)

Etiology.—The causes of renal distension may be enumerated as follows :—

Congenital. — Those occurring during gestation which lead to the presence of this condition at birth; usually not within the range of surgical interference. They include (*a*) abnormalities of the ureter and of the lower urinary passages; and (*b*) abnormalities of vessels, or in the attachment of the ureter to the renal pelvis, which lead at a later period of development to obstruction.

Acquired.—(*a*) Urethral stricture, prostatic enlargement, frequent and sustained vesical systole; (*b*) simple or malignant pelvic tumours or displacements; (*c*) other growths in the pelvis or lower abdomen, such as enlarged glands or exostoses; (*d*) bands and adhesions resulting from peritonitis; (*e*) stenosis from ureteritis, simple or

tuberculous; (f) impacted calculi and pockets and valves in the ureter; (g) bends and twists of the ureter from undue mobility of the kidney; (h) valvular obstruction at the junction of the renal pelvis and ureter or in the renal pelvis itself; (i) obstruction resulting from traumatism.

Some years ago I pointed out in the Medical Society's *Transactions* (1894, p. 80) that it was hardly reasonable to expect always to find the cause of an advanced hydro-nephrosis.

Former mobility of the kidney which had from time to time kinked or otherwise obstructed the ureter might lead to obstruction and dilatation, but the organ might become fixed in the process of its enlarging, so that on subsequent examination, the cause as a pathological entity no longer exists. I further suggested that often there is a variation in the resisting power of different parts of the kidney and ureter (Fig. 45); the weak parts yielding first and most; that it is quite conceivable—indeed cases in process of development tend to show—that a slight temporary obstruction might bulge the pelvis at
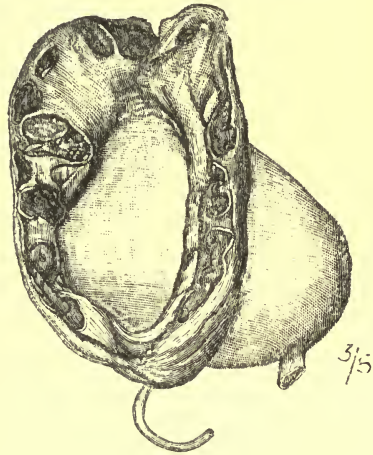
Fig. 46.—Hydro-nephrosis with great dilatation of the Pelvis and very little Renal Substance remaining. (Middlesex Hospital Museum.)

one part and that this pouch may by degrees completely obliterate the ureter by its weight, very much as an aneurysm sometimes obliterates the artery above or below it; or a valve may come to be formed at the uretero-renal orifice. Maintenance of the recumbent position might have much to do with the production of hydro-nephrosis, particularly in invalids suffering from pelvic disease. In the horizontal posture some comparatively slight obstruction low down in the ureter would be sufficient to keep that tube full without dilating the whole of it, and yet some weak part of the wall or renal pelvis might yield. It does not follow that the obstruction had not been low down in its course simply because the ureter was not dilated in its whole length, nor that a cause of obstruction had not existed

because none is found at the post-mortem examination.   A calculus for example, after causing partial obstruction for months or years, might pass and leave no trace of its existence.

Two forms of renal distension, in particular, come before the notice of operating surgeons, either or neither of which may cause a tumour clinically detectable — the one a large thin-walled cyst in which scarcely any renal tissue remains (Figs. 46 and 48), which completely empties on tapping; the other presenting dilated calyces separated from one another by dense fibrous septa and having in addition a large amount of thickened and hypertrophied parenchyma (Figs. 47 and 49).   This condition is especially apt to be met with when in consequence of the functional disuse of one kidney, the other has undergone compensatory hypertrophy before it, in its turn, becomes dilated; and also in cases where great irritation as well as intermittent obstruction has existed for a long period, as in some instances of calculous pyo-nephrosis in which interstitial nephritis has been going on simultaneously with dilatation.

I. Hydro-nephrosis.

Hydro-nephrosis is the term applied to over-distension of the kidney with urine.   It is a mechanical result of obstruction to the outflow of urine from the kidney, no matter whether the cause of the obstruction be situated in the urethra, bladder, or ureter; nor whether a renal tumour appreciable during life be formed by the dilated kidney or not.   It is necessary, however, for the production of a hydro-nephrosis that the obstruction be incomplete, or if complete only temporary, for a complete and permanent obstruction is followed by atrophy of the kidney.

In the most extreme cases the seat of obstruction is generally the ureter or the vesical orifice of the ureter.   In double hydro-nephrosis, in which the degree of distension is often less excessive, the seat of the obstruction is in, or in front of, the bladder.

It is long since a special name was first given to this condition.   Martineau, in 1785, called it " hydrops renis "; Frederick A. Walter, in 1880, called it " hydrops renalis "; and James Johnson, in 1816, suggested " hydro-renal distension "; but since the publication of Rayer's " Traité des Maladies des Reins " in 1841, the term " hydro-nephrosis " has been in common use.

Hydro-nephrosis is not to be confounded with renal cysts, and therefore the term " cystic tumour of the kidney," which has also been employed, is too vague ; for whilst it includes and implies many different cystic conditions, it by no means indicates " distension by backward fluid pressure."

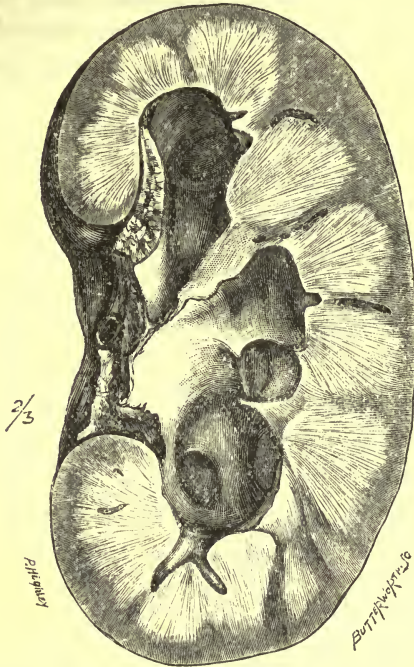It is more especially since the days of ovariotomy and the

Fig. 47.—Hydro-nephrotic Kidney, with large amount of Secreting Tissue remaining. From a case of cancer of the uterus involving the base of the bladder, and causing obstruction of the ureters. (Middlesex Hospital Museum.)

removal of other abdominal tumours that cases of hydro-nephrosis have been carefully studied and better understood.

Etiology.—The causes of hydro-nephrosis are (1) congenital and (2) acquired. Probably in one-third of the cases in which a palpable tumour is formed the obstruction is of a congenital nature. Roberts found a congenital malformation (affecting kidney, ureter, or renal artery) in twenty out of fifty-two cases. In four cases the ureter was congenitally imperforate ; in three it entered too obliquely into the pelvis of the kidney ; in two a super numerary renal artery crossed and compressed the ureter near

its origin.   In thirteen out of the twenty cases the hydro-nephrosis
was double ; and of these, two were still-born, five died within
five months, and the others lived for periods varying from five
and a half to thirty-eight years.

The congenital causes do not always give rise to hydro-nephrosis
in infancy or very young life.   There are several cases on record
which show that a congenital cause has acted very slowly and
incompletely, if at all, for a long time ; but that after some,
even many years, a hydro-nephrotic tumour has been formed

Fig. 48.—Hydro-nephrotic Kidney which has become a mere Cyst.
(Middlesex Hospital Museum.)

and terminated fatally.   Hydro-nephrosis due to a congenital
cause is not therefore the same thing as " congenital hydro-
nephrosis," a subject upon which something will be said later on.

Amongst the *congenital causes* are to be found a very tightly
contracted preputial orifice (*see* Fig, 50) twists of the ureter
upon its own axis (Hare), undue obliquity of its insertion
into the renal pelvis so that a valve-like condition is formed
which prevents a free outflow (Roberts, Thompson, Dumreicher),
reduplications, folds, contractions (Rayer), and other anomalies
of the ureter.   Sometimes the ureter has been replaced in part, or
throughout, by a fibrous cord (Thurnam) ; but absence of the ureter
is generally accompanied by atrophy of the kidney.   Occasionally
hydro-nephrosis and pyo-nephrosis arise from congenital diver-
ticula connected with the kidneys.   In a case recorded by Braun,

a tumour of this kind was found in a child, four months old, and formed a pyo-nephrosis at least as large as a child's head.

In other cases the vesical orifice of the ureter is thick, rigid, and of merely pin-hole size (Reynaud and Steiner); in others, again, minute cysts are developed upon its mucous membrane; in others, the ureter joins the kidney at such an acute angle that urine can only flow downwards with difficulty, if at all, though a probe
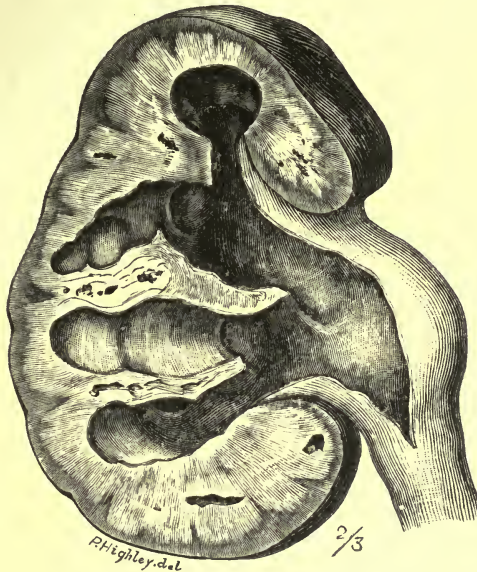

Fig. 49.—Hydro-nephrotic Kidney, with thick partitions between the Sacculi and considerable dilatation of the Pelvis. (Hunterian Museum.)

can be readily passed along the ureter from below. In other cases, again, an anomalous opening of the lower end of the ureter into the urethra or elsewhere may prevent a free outflow of urine.

Walter described the case of a man, aged thirty years, who had two ureters and two pelves to each kidney; the upper part of his right kidney was converted into a cyst, the right upper ureter was dilated and opened into the bladder close to the prostate, and passed down in front of the right lower ureter, which opened almost in the median line of the bladder. The right lower ureter and lower half of the right kidney were not distended.

A specimen in the Middlesex Hospital Museum well shows a kidney with two ureters, the lower of which is opening into the bladder near the vesical orifice.   This ureter is sacculated, and
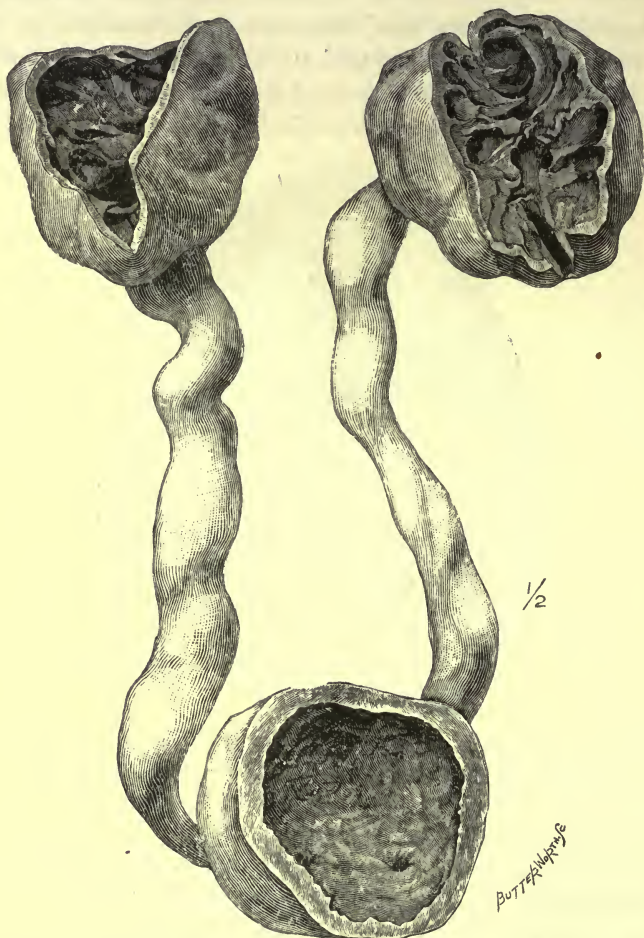

Fig. 50.—Double Hydro-nephrosis and dilatation and torsion of Ureters in a child with a very small preputial aperture.   (St. Bartholomew's Hospital Museum.)

the lower part of the kidney which it drains is converted into a pyo-nephrosis.   The upper part of this kidney, drained by a ureter opening normally into the bladder but in which a small calculus is fixed at its upper extremity, is becoming hydro-nephrotic (Fig. 51).   At the Congress of Surgery in 1891 a case was reported

in which the superior half of the kidney was healthy. This
is contrary to the statement made by Brinon (*Thèse de Paris*,
1896), who says that it is almost always the ureter corresponding

Calculus impacted in
the upper end of the
ureter.

$\frac{2}{5}$
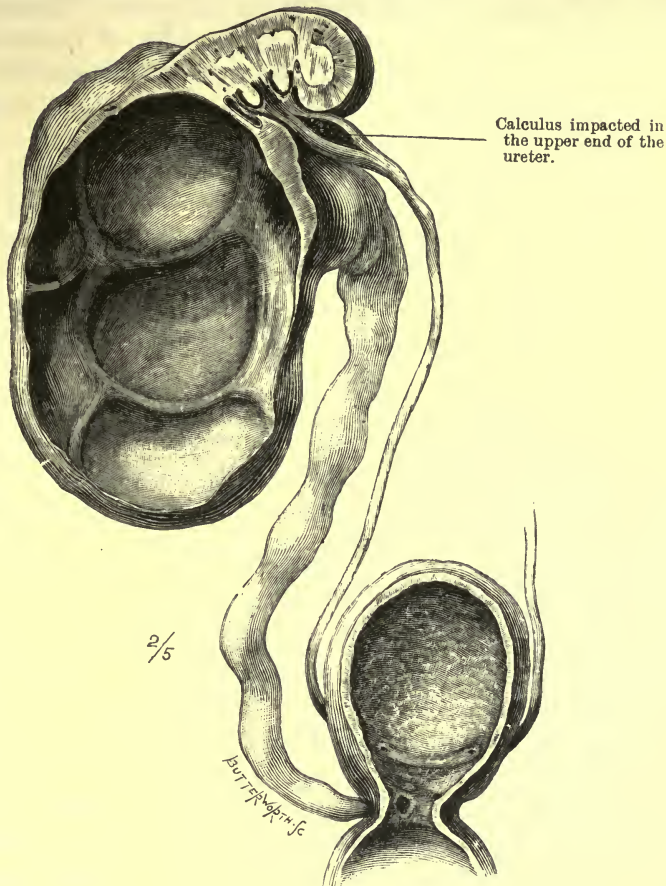
Fig. 51.—Hydro-nephrosis of the Right Kidney with Double Ureters
(*see* text, p. 402). (Middlesex Hospital Museum.)

to the upper half of the kidney which opens abnormally, and
therefore the upper half of the kidney which becomes dilated.

In a case related by Boogard of a young man, aged twenty,
who died five days only after the hydro-nephrosis was first
observed, the right renal artery divided into two branches the
lower of which compressed the ureter.   Roberts[*] records a case

[*] "Urinary and Renal Diseases," p. 545 (4th ed.).

in a young man of twenty years, who had double hydro-neph-rosis, that on the left side having been caused by a contracted and too oblique ureter, and that on the right side by the pressure of a branch of a renal artery on the ureter. Krause described the case of a woman in whom a valvular flap of membrane at the renal orifice of the ureter was the cause of obstruction. Lagrave found a kidney hydro-nephrotic from compression of the ureter by menses retained in one-half of a bifid uterus.

Torsion of the penis is another congenital cause of double hydro-ureter and hydro-nephrosis. A case of this kind I recorded and illustrated in the *Lancet* for June 8th, 1895 (*see* section on Congenital Hydro-nephrosis, p. 440).

Dr. Strange* records the case of a farm labourer, aged eighteen, in whom diabetes insipidus had existed from infancy. The kidneys at the time of death were mere sacs two or three times larger than normal kidneys, and there was a complete absence of all parenchymatous substance, both cortical and tubular ; the sacs were divided into a number of cells by the intertubular septa which occur in the fœtal state. The ureters were also greatly dilated, being from three to four and a half inches in circumference. The urine contained in the sacs and ureters had no urea, no albumen, and no sugar.

Another very similar case is recorded by Faber,† in which the belly was enlarged from birth, and there were recurring paroxysms of symptoms like those of stone in the bladder ; the boy died at the age of five and a half years, when both kidneys were found converted into large sacculated pouches without a trace of renal substance in them ; and the ureters were like the small intestine in size.

In these two cases the atrophy of the renal substance had doubtless commenced at or before birth, and had gone on progressively afterwards.

The *acquired causes* of hydro-nephrosis are numerous, and, like the congenital, may be situated in, behind, or in front of the bladder.

From the records of the post-mortem examinations of 2,610 bodies, made during the ten years ending 1883 at the Middlesex Hospital, I found 142 cases of marked hydro-nephrosis. Slight and only moderate dilatations of the kidney are not included

* Beale's " Archives," p. 276 ; 1862.
† Wurtz, *Correspondenz-Blatt*, Bd. xii., p. 266.

in this number, but only those cases in which there was very advanced change in the kidney. Many of these kidneys are described by the words "enormously dilated"; as large as "an orange" or as "a cocoanut"; "pelvis distended and renal substance atrophied, so as to leave a thin-walled chambered cyst"; "pelvis dilated into a large pouch" (Fig. 52); "renal substance wasted so that the solid part of the kidney formed a mass not larger than a large walnut"; "kidney small, but converted into a mere chambered cyst, the ureter greatly dilated"; "pelvis and calyces widely distended, ureter the size of the small intestine of a child." These and similar expressions are used to describe the cases included in the list. In some instances of double hydro-nephrosis it is quite clear that one kidney was affected long before the other; and that in the meanwhile the second kidney had undergone considerable hyper-
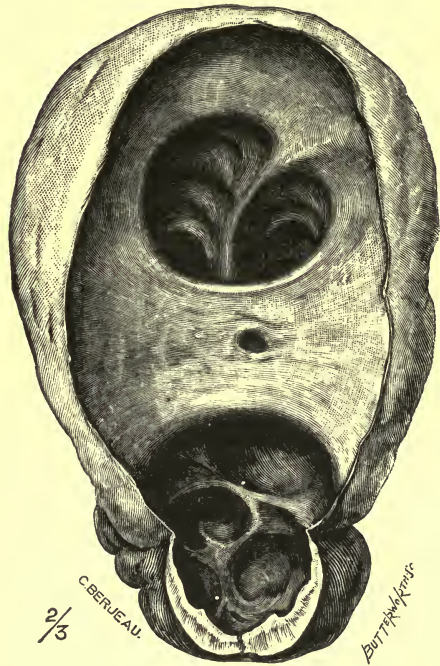

Fig. 52.—Hydro-nephrosis with great dilatation of the Renal Pelvis, from a lady whose other Kidney became movable and then hydro-nephrotic, and was subsequently submitted to nephrotresis (*see* p. 437). (Midd. Hos. Mus.)

trophy. Hence the apparently incompatible conditions of great distension of ureter, of the pelvis and calyces of the kidney, and great bulk of renal substance, were sometimes co-existing in the same organ.

An analysis of the 142 cases shows the causes to have been:

1. Cancer of the pelvic organs, uterus, vagina, bladder, or rectum, in 116 cases.

2. Cancer of one or both ovaries in two cases.

Of the 116 cases (most of which were primarily uterine cancers,

though in many of these the vagina, bladder, or rectum became subsequently involved)—

93 were double hydro-nephrosis.
16 affected the right kidney only.
7 affected the left kidney only.

Of the two cases of ovarian cancer

1 affected the right kidney only, the right ovary only being diseased.
1 affected both kidneys, both ovaries being diseased.

Of the twenty-four remaining cases the cause was

Unknown in 4.
Cystitis in 3.
Vesical calculus, 3.
Villous growth of bladder, 1.
Enlarged prostate, 3.
Ovarian cysts, 4.
Constriction of ureter, 3.
Cancer of abdominal organs pressing on ureter, 3.

Of these twenty-four cases due to causes other than pelvic cancer

12 were double.
9 affected the right kidney only.
3 affected the left kidney only.

Of the twelve cases in which the hydro-nephrosis was single, the dilatation was due

To causes " unknown "   4
To constriction of one ureter   3
To S-shaped twist in ureter   1
To cancerous tumours in *abdomen*   3
To ovarian cyst   1

In the twelve cases in which the hydro-nephrosis was double, the causes were

Cystitis   .   .   :   .   3 | Enlarged prostate   .   3
Vesical calculus   .   .   3 | Ovarian cysts   .   .   3

In a further analysis of 3,926 cases from the post-mortem records of the Middlesex Hospital between 1884 and 1897, there were 239 cases of hydro-nephrosis due to pressure on the ureters, in most cases from malignant disease in the pelvis; of these, 170 were bilateral and sixty-nine unilateral.

In addition to these, there were five cases of unilateral hydro-nephrosis due to renal or ureteral calculus.

Thus, out of a total of 381 cases of hydro-nephrosis, taken from the post-mortem records of the Middlesex Hospital, 274 were bilateral and 107 unilateral.

In thirty-two cases recorded by the late Sir William Roberts, the cause was found to be impaction of calculus in the ureter in eleven, and in three others it was presumably due to this same cause, though the calculus was not actually discovered ; in five there was a narrowing or obliteration of the ureter near its origin or termination, produced presumably by some preceding inflammation or ulceration ; in six cases the ureter had been compressed by pelvic tumours ; and in three by peritoneal inflammatory bands.

Simon found calculus to be the cause of hydro-nephrosis seven times in eighteen cases (Legueu).

It will be thus seen that a not uncommon, and to the practical surgeon a very important cause, is a calculus impacted in the renal pelvis or in the ureter ; and besides the cases in which there is a calculus discovered, there are also those in which the passage of a calculus from the kidney to the bladder has left its effects in the form of ulceration and subsequent contraction of the ureter at some spot or other.

Traumatism is occasionally, though not very commonly, followed by hydro-nephrosis, and many cases supposed to be of this nature are in reality due to urinary effusions into the retro-peritoneal tissue after an injury to the kidney or ureter, an instance of which was well described by Stanley.*   This condition has been termed " pseudo-hydro-nephrosis," and is generally to be distinguished from the true variety by the earlier onset after the accident ; and in the cases where a post-mortem examination has been made, there has been no dilatation of the renal pelvis found. When a true hydro-nephrosis results from traumatism it generally depends upon a stricture of the ureter, and is not developed until a long time after the injury.

A case of this kind is recorded by Dr. Pye Smith in a farrier, aged twenty-four, who was kicked " under the short ribs," and passed blood with his water ; two years later a hydro-nephrotic tumour on the same side of the abdomen (the left) was discovered and twice tapped ; at the post-mortem examination the ureter was dilated for an inch and a half and then suddenly became contracted so as not to admit the smallest probe.   The cyst communicated with the adherent intestine.   The contraction of the ureter was supposed to have been caused by the kick.

* *Trans. Roy. Med.-Chir. Soc.*, xxvii., p. 1.

Other cases in which hydro-nephrosis has followed an injury to the ureter are recorded in the chapters on Injuries of the Ureter in the second volume of this work. A more doubtful case is referred to later in the present chapter (p. 425).

In other cases, again, the ureter has been found degenerated into a hard, slender, impervious cord, but the cause of the obliteration was not so clear as in the above-quoted cases. Thus, Cooper Rose records the case of a young lady who suffered from a tumour of the abdomen for fifteen years, which was throughout supposed to be ovarian, and was tapped; nothing but a thin layer of cortical substance was left of the kidney; the ureter was quite impervious.

Other causes of obstruction to the outflow of urine are contraction of the vesical orifice of the ureter from inflammation, ulceration, and tumours or abscess of the bladder; abscess of the pelvic cellular tissue when affecting the lower part of the ureter; enlarged lymphatic glands which press upon the ureter in any part of its course; adhesions, or bands of fibrous tissue; cancer of the pelvic organs; stone in the bladder; enlarged prostate, stricture of urethra; and in the female various morbid conditions of the uterus and its appendages. A case of obstruction of the ureter by a gumma has been recorded by Hadden in the *Transactions* of the Pathological Society (xxxvii., p. 301). The patient, a man fifty-five, died of strangulated inguinal hernia. The right ureter was dilated to more than twice its normal size down to a point $4\frac{1}{2}$ inches from its entrance into the bladder; below this the duct became very small, and its lower end just admitted the passage of an ordinary probe. The obstructing mass involved the bifurcation of the common iliac artery. The right kidney was entirely cystic. There were gummata in the liver and spleen.

Ebstein* gives an instance of double hydro-nephrosis due to an abscess at the fundus of the bladder following lateral lithotomy : the orifices of the ureter lay within the area of the abscess; each ureter was dilated to the size of the small intestine; both kidneys were exceedingly enlarged, the left being completely transformed into a hydro-nephrotic sac with scarcely a trace of renal substance remaining. I have seen a sacculus in a thin dilated bladder (associated with, if not caused by, enlarged prostate) which had produced great dilatation of one ureter

---

* Ziemssen's " Encyclopædia," vol. xv., p. 647.

from dragging upon and partly occluding the ureteral orifice. Prolapse of the vesical orifice of the ureter, and a calculus lodged in a pouch of the ureter at or just above the vesical orifice, have also given rise to unilateral hydro-nephrosis.

In two cases which have been under my care villous papillomata of the bladder have been the cause of hydro-nephrosis. One case will be again referred to further on; in the other, extensive double hydro-nephrosis (not, however, amounting to an abdominal tumour) was due to widespread villous disease of the bladder.

Movable kidney is said to be a frequent cause of hydro-nephrosis, especially of the intermittent variety. The change in the position of the kidney causes a kink to form in the ureter, which may vary from the slightest torsion to an extreme degree of spiral twisting. A very slight amount of flexion of the ureter is suffi- cient to check the flow of urine, with the result that the ureter and renal pelvis undergo dilatation above the point of obstruction. This dilatation increases and persists until the pressure of the urine becomes great enough to overcome the resistance, or else, as frequently happens, the mobile kidney assumes a new position, which is more favourable to the outflow of the urine, and the sac then empties itself. The rapidity with which the urine escapes varies in each case according to the nature of the obstruction, and external manipulation or alterations in the position of the patient not unfrequently facilitates the flow. The relation between movable kidney and hydro-nephrosis has been studied experimentally on animals by Tuffier; and although he found a definite causal relationship between the two conditions to exist, a movable kidney was by no means invariably followed by hydro-nephrosis. This fact is in keeping with clinical observations, for only a very small proportion of the movable kidneys in men and women are complicated by hydro-nephrosis; and I am much disposed to think that in several cases in which hydro-nephrosis and movable kidney co-exist, the mobility was acquired after, not before, the hydro- nephrosis, and is a result of the dragging weight of the distended organ.

Silbermann mentions a case seen by him in a child ten years old, in whom hydro-nephrosis of the right kidney was caused by a fibroma of the bladder about the size of a walnut which blocked the vesical orifice of the right ureter.* The case

* *Berliner klinische Wochenschrift*, xx., p. 518; 1883.

is of interest because the condition suggested to Silbermann the instrument he has devised for temporarily closing one ureter.

Dr. Simpson * saw a right kidney which had been converted into a cyst the size of a fœtal head by a thickened band of fibrous tissue passing along the brim of the pelvis from the promontory of the sacrum, and compressing the right ureter.

Rayer mentions the case of a woman, aged forty, who had a fluctuating tumour in the right side caused by compression of the ureter by enlarged and indurated lymphatic glands, between the uterus and iliacus muscle, secondary to cancer of the uterus ; the left kidney and ureter were unaffected.

Pelvic tumours, cancer of the pelvic organs, versions and flexions of the uterus, enlargement of the prostate, stricture of the urethra, and phimosis, though frequent causes of hydro-nephrosis, only occasionally lead to such an amount of distension as to produce an abdominal tumour.

Amongst the numerous cases of cancer of the pelvic organs annually examined at the Middlesex Hospital, there had not been, up to 1885, in the memory of any of the surgeons then attached to the hospital, a single clinical instance of an abdominal tumour from hydro-nephrosis due to pelvic cancer ; nor am I aware that any such case has occurred since.   Rayer had only seen one case, that just referred to, in which hydro-nephrosis from cancer of the uterus gave rise to an abdominal swelling, and in that case the immediate cause of the renal distension was pressure by enlarged pelvic lymphatic glands.

Hildebrandt considers retroflexion of the uterus an occasional cause of hydro-nephrosis, and he records such a case in his writing on retroflexion ; he explains it by the bending of the ureters, as they pass along by the side of the neck of the uterus, owing to the version of the womb, and this in turn causing obstruction to the outflow of urine from the kidneys. He found a large soft tumour above Poupart's ligament on the left side, which was removed by pressure on the abdominal walls when a catheter was introduced into the bladder and the uterus was straightened by a sound.   The swelling in another and similar case was best felt when the patient was upright, because in the recumbent position

* *Glasgow Medical Journal*, vol. ii., 1867.

the urine was dispersed along the whole length of the ureter, and thus did not form a circumscribed swelling.

There is one cause of obstruction to the outflow of urine from the kidneys which, though it may not be sufficient of itself to give rise to a hydro-nephrotic tumour, doubtless aids materially any partial obstruction of one or both ureters from any other cause, such as renal calculus or morbid growth of the bladder. I allude to frequency of micturition, which means frequent contraction of the muscular walls of the bladder; frequent closure of the vesical orifices of the ureters owing to the anatomical arrangement whereby these ducts traverse the parietes of the bladder; and thus frequent resistance to the outflow of the urine from the ureters.

Dr. Alexander James has reported a case in the *Edinburgh Medical Journal* (p. 135, 1877), in which frequent micturition due to phimosis was, he believes, the proximate cause of the hydro-nephrosis, the contractions of the bladder preventing the flow of urine through the ureters. I refer with special satisfaction to Dr. James's paper on hydro-nephrosis because I did not know of its existence when writing the above many years ago. Dr. James * observed many times, in washing out the bladder of a paraplegic patient, that its walls would remain so firmly contracted round the catheter for thirty seconds or longer at a time, as not to allow a single drop of water, even with a head of three feet, to enter the viscus. This, as he remarks, is specially interesting, as helping to show that the increased frequency of micturition which occurs in irritable bladders will cause dilatation of the ureters and renal pelvis by damming back the urine in those tubes. It seems to me very probable that it is in this manner that phimosis, stricture of the urethra, prostatic enlargement, vesical calculus, and other such causes of frequent and straining micturition, lead to hydro-nephrosis; for these conditions do not *directly obstruct the ureters* as do an impacted renal calculus, a papilloma growing over the ureteral orifice, a pelvic tumour, and the various other obstacles situated above the bladder. Hydro-nephrosis has occasionally arisen in the course of diabetes, probably through the secretion of urine being so much in excess of the outflow that dilatation finally takes place (Saundby. *See* also Dr. Strange's case, quoted on p. 404).

* *Edinburgh Medical Journal*, Nov., 1878.

Hydro-nephrosis may affect *both kidneys, or only one, or may even be limited to only part of one kidney.* According to Roberts, out of thirty-two cases in which the cause of obstruction was not congenital, the hydro-nephrosis was double in seven; as against thirteen cases out of twenty in which the cause of the obstruction (and in several the tumour also) was congenital. As stated on p. 406, the hydro-nephrosis was double in 276 out of 386 cases of hydro-nephrosis collected from the records of the Middlesex Hospital.

In rare cases the hydro-nephrosis has been partial as well as unilateral; *i.e.* it has involved some only of the calyces of the kidney. This has been the condition in some few instances in which there have been two ureters to a kidney, one of which only has been occluded or obstructed (*see* Fig. 51); but it has also been seen when the cause of the obstruction has occupied the renal pelvis and upper end of the ureter (Figs. 53 and 54). Cases of partial nephrectasis (hydro-nephrosis and pyo-nephrosis) were referred to by Rayer, and by myself in my earlier work on the "Surgical Diseases of the Kidney" (1885). The subject has been more recently illustrated by Fenger of Chicago,[*] Israel, and others.

Unsymmetrical as well as horse-shoe kidneys may of course become hydro-nephrotic, and children have been born with a single kidney and ureter greatly dilated. There are several cases of hydro-nephrosis of single kidneys on record.

John Wood [†] recorded the case of a girl, aged ten years, with a double pelvis and ureter to her left kidney, and a single undersized ureter issuing from the lower end of the right kidney. At the upper end of the right kidney was a cyst the size of a walnut, with tough fibrous walls, and with a thin layer of cortical substance spread some way over its walls. The interior was lined by a smooth membrane, had no communication with the true pelvis of the kidney, and here and there was marked by saccular depressions like the remains of calyces. Emerging from the cyst was a fibrous tube of the average diameter of a goosequill, but sacculated in places. Its lumen communicated with the cavity of the cyst; its lower end opened into the bladder by a narrow aperture guarded by a valve near the urethral orifice. Towards its lower end were two or three distinct valvular folds

[*] *Annals of Surgery*, 1890, and *Amer. Med. Assoc. Journal*, 1894.
[†] *Path. Soc. Trans.*, vol. vii., p. 261.

of the lining membrane, strengthened by fibrous tissue, and disposed so as to resist upward flow. The cyst seems to have been a hydro-nephrotic distension of certain calyces communicating with the aberrant ureter.

Dr. Ewart* has recorded a case in which the lower part of each kidney was a sacculated cyst, the cause being tuberculous disease of the corresponding ureter. Each kidney had two ureters.
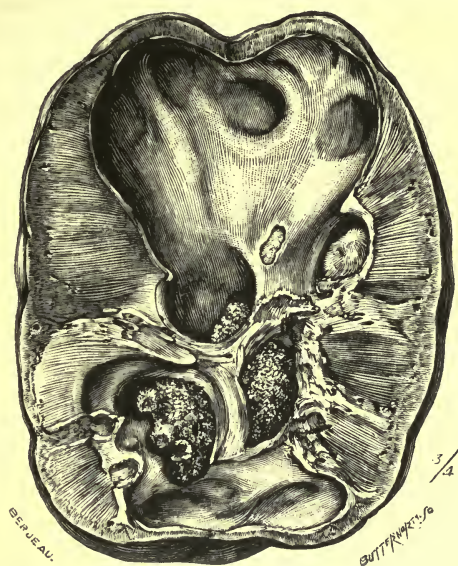

Fig. 53.—Section of Hydro-nephrotic Kidney with a Uric Acid Calculus impacted in the Pelvis, and extending into the upper part of the Ureter, which it blocks. The pelvis is dilated, and the medullary and cortical substances of the kidney have undergone absorption in very different degrees in different parts of the organ. (Westminster Hospital Museum.)

The *distension of only one calyx has even given rise to an abdominal tumour*, as in Fugel's case.† In a case of horse-shoe kidney ‡ the left part of the organ was atrophied, and its pelvis was dilated owing to pressure on the ureter of this part. The right part of the horse-shoe mass weighed fifteen to sixteen ounces, its pelvis also was somewhat dilated and inflamed, and its substance was suppurating. There was inflammation of the whole

* *Path. Soc. Trans.*, vol. xxxi., p. 188.
† Referred to by Staples in *Journ. of Amer. Med. Assoc.*, April 19, 1884.
‡ *Guy's Post-mortem Records*, 1877, No. 372.

of the retro-peritoneal tissue surrounding the kidney. The cause
was pelvic cellulitis after delivery. Two or three cases of ab-
dominal tumour, caused by one half of a horse-shoe kidney,
are on record. I have given an illustration in the section on pyo-
nephrosis of a horse-shoe kidney one-half of which is distended into
a large pus sac. Sutherland and Edington have also figured a
horse-shoe kidney from a child aged three years, the left half
of which is greatly enlarged, and has the characters of an ordinary
non-tuberculous pyo-nephrosis.*
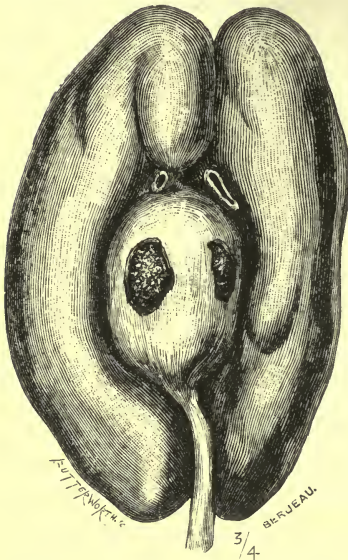
Fig. 54.—Kidney shown in section
in Fig. 53. The upper end of the
ureter is blocked by the calculus.

*The proportion of cases in which
hydro-nephrosis produces a palpable
abdominal tumour* is very small,
compared with the great frequency
of hydro-nephrosis as it is seen
in the post-mortem room. When
an abdominal swelling exists there
has been more or less complete
obstruction affecting a kidney in
its full functions; the kidney may
even be greatly hypertrophied.
Moreover, in all probability the ob-
struction will have been of long
standing, and either intermittent, or
continuous and partial in its action.

Up to the time of obstruction
the kidney will have been actively
secreting; it still goes on secreting,
and the urine, finding difficulty in
its exit, dilates the renal pelvis, and
as much of the ureter as is above the obstruction. In proportion as
the renal tissue becomes destroyed by the compression, the amount of
urine secreted is lessened; but still the distension will increase, and
the sacculated kidney will enlarge as long as there is any secreting
structure left to add more urine to that already accumulated. If
the kidney thus obstructed has previously undergone hypertrophy,
the distension will increase with even greater force than in a kidney
of usual size, and the hypertrophied organ will, from its own size,
assist in making the hydro-nephrotic swelling more prominent.

* *Glasgow Medical Journal*, Feb., 1898.

When, on the other hand, the obstacle is slight at first, and only very gradually increases (as in organic stricture and cancer of the uterus), there is a continual mild resistance, rather than an actual obstruction, to the flow of urine, so that the secreting substance of the kidney wastes more quickly than the renal pelvis distends, and death occurs generally before a tumour is formed. In
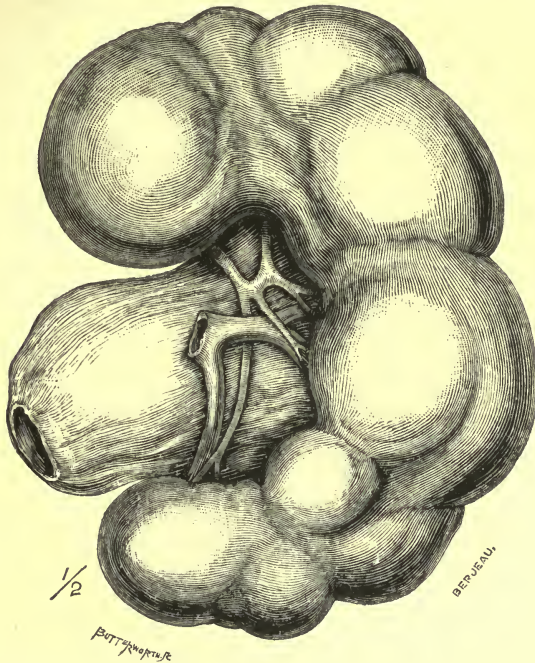

Fig. 55.—Hydro-nephrosis, showing dilatation of the Renal Pelvis and lobulation of the Hydro-nephrotic Sac. (St. Thomas's Hospital Museum.)

urethral stricture, and in most cases of uterine disease, resistance is offered to both kidneys, and they each suffer, but cannot share the results of the obstruction. Thus there is little chance of detecting hydro-nephrosis from such causes during life, unless the obstruction has been confined to one side for a time, and affects the other kidney after it has become hypertrophied.

When sudden and complete, or nearly complete obstruction affects the kidney, atrophy, and not hydro-nephrotic distension of that organ, will result, as has already been explained.

It is seldom that the clinical history and course of a case

of hydro-nephrosis afford accurate data for forming an opinion as to the *rate of " growth,"* or development of an abdominal tumour of this nature; but a case of hæmato-nephrosis, communicated by M. Danyau and quoted in one of the chapters on Injuries of the Kidney, is of much value as proving that the pyramidal and cortical substance of the kidney may be quite destroyed,
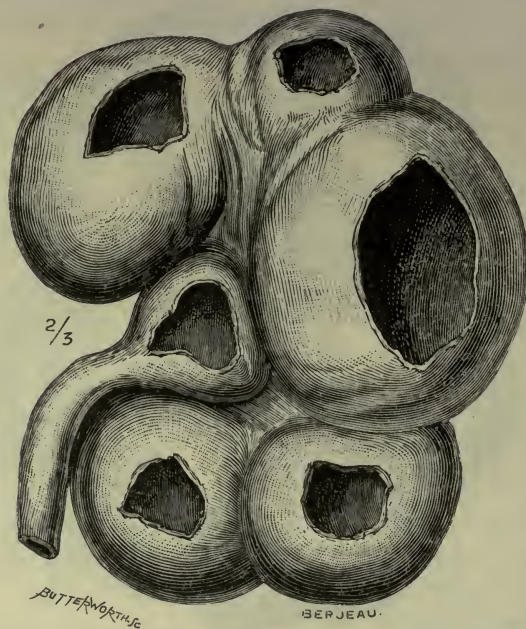

Fig. 56.—Hydro-nephrosis; the kidney distended into a thin-walled sac, which is lobulated externally. The upper end of the ureter is dilated. (St. Thomas's Hospital Museum.)

and a large tumour formed, by intrarenal pressure in a period of less than two calendar months. As there was no reason to suppose that the injured kidney had been at all dilated prior to the accident, we have in this instance almost certain knowledge of the *maximum* time within which these extreme results of intrarenal pressure were produced. The condition was not, however, the same as it is in hydro-nephrosis, because the dilating force in that case was the projection of arterial blood into the obstructed kidney; and the result was the formation of a false aneurysm within the renal cavity.

Pathology.—The characteristic changes in hydro-nephrosis consist of a dilatation of the pelvis followed by gradual absorption of the kidney substance, until in the late stages there is nothing but a mere cyst or a combination of pouches. It is, however, rare to find all the renal tissue entirely destroyed, and Ayrer * found this condition only eleven times in 473 cases. The anatomical appearances may also vary with the nature of the hydro-nephrosis, as to whether it is of
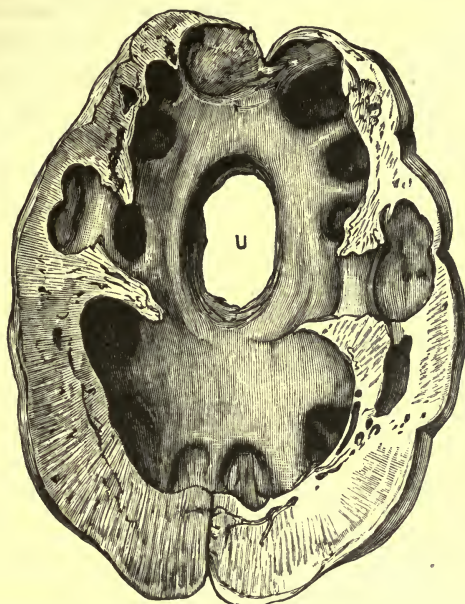

Fig. 57.—Kidney removed for extreme Hydro-nephrosis. The kidney had been movable for several years. The renal pelvis is greatly dilated. (Author's case.)
u, Ureter as it leaves the hilum of the kidney.

the open or closed variety, or whether the distension affects only part of the organ, as it does in some cases where there are two ureters. In a typical case the pelvis of the kidney first becomes converted into a spheroidal sac, then the calyces are widened and stretched in every direction, and at length the capsule of the kidney is expanded, and what remains of the cortical and medullary substance of the organ becomes still further compressed and absorbed, until at length there is nothing left but a multi-loculated bladder or cyst (Figs. 55 and 56). Thus the tension exerted by the urine, which accumulates

* "On Complete Atrophy of the Kidney Substance in Hydro-nephrosis," *Deut. Med. Wochschr., Leipz. u. Berl.*, 1893, xix., pp. 1108 and 1159.

behind the obstruction, stretches the calyces and flattens and wastes the pyramids to such an extent that the calyces are converted into huge spaces or pouches jutting off from the dilated pelvis and separated from one another by slender septa formed by the wasted " columns of Bertini" (Fig. 57). On laying open the cavity of such a hydro-nephrotic cyst, nothing but a complete fibrous skeleton of the kidney will be seen. Sometimes nothing
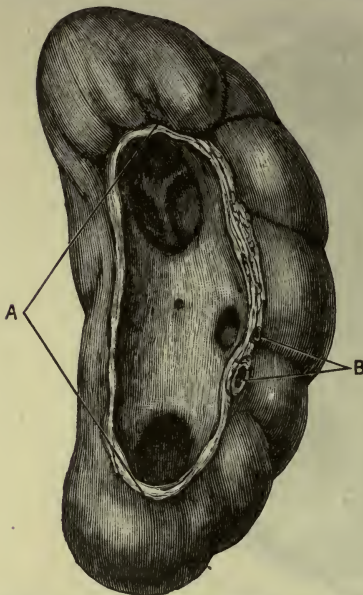

Fig. 58.—Hyuro-nephrosis which subsequently suppurated. Great dilatation of the Renal Pelvis (a) and upper end of Ureter, with Atrophy of Renal Vessels (b). Calyces opening by three apertures into the pelvis. Removed by author. (Middlesex Hospital Museum.)

but a pellucid sac, with at most one or two, if any, septa is present (Fig. 48, p. 400); at others, again, and this is more generally the case, traces of the renal tissue remain as in Fig. 49 (p. 401), where the pelvis of the kidney is seen greatly enlarged, and areas of secreting substance have been exposed in the section.

As a rule, the pouches formed by the dilated calyces communicate indirectly with one another through their openings into the pelvis (Fig. 58); but in rare cases one or other or all of them may be shut off from the pelvis, and therefore from one another, either by the presence of a large branched calculus or by fibrous septa.

There are great varieties in the proportions in which the pelvis and the body of the kidney enter into the formation of the cyst ; in one case it is formed in greater proportion by the pelvis, which is converted into a rounded tumour as in Fig. 52 (p. 405) and Fig. 59 ; in another, the absorption of the renal substance, far from being complete, may not amount to more than an effacement of the papillæ and a flattening of the pyramids (Fig. 47, p. 399). Again, in another case the whole of the pyramids may have disappeared, but the cortical portion remains scarcely, if at all, encroached upon ; in a third stage, the cortical as well as the pyramidal substance has vanished, and nothing but mere reddish areas

on the fibrous parietes (if anything) remain of the secreting tissue (Fig. 46, p. 397).

The *walls* vary in thickness very much ; in one case they are composed of a thin translucent delicate membrane ; in another, of condensed white connective tissue tough and strong, and sometimes even of the consistence of cartilage ; in a third, fibrocartilaginous nodules may be found embedded in them. G. W. Perkins records a case of traumatic hydro-nephrosis, with calcification of the cyst wall, in a man aged thirty-nine. When eight years old he had been run over by a waggon, which traversed his abdomen and rendered him for a time unconscious, but otherwise he suffered no immediate serious symptoms. After the lapse of a year, a lump the size of a hen's egg appeared in the right iliac region, which enlarged only slowly till he was fifteen. At twenty-three, after a fall, some pain ensued, and the swelling was tapped ; a quantity of clear yellow fluid, weighing thirty pounds, with a glistening oily scum on the surface, was removed.

Three years later the swelling returned, and ultimately the whole of the right side of the abdomen was filled with an elastic swelling. Nearly nine pounds of semi-solid and fluid contents were removed, leaving an enormous cavity, with dense strong walls which did not collapse, but maintained nearly the original shape and size of the tumour, and gave out a ringing sound when tapped with an instrument. There was no kidney tissue present. The urine at the time was normal. Eight weeks later death occurred, within ten minutes, from sudden hæmorrhage into the cavity. Post-mortem a cyst was found, kidney shaped, measuring eleven inches by six, and with walls half an inch thick, composed of fibrous tissue, with a lining of calcareous matter, $\frac{1}{32}$ to $\frac{1}{16}$ inch thick. The left kidney was greatly enlarged, weighing twelve ounces.*

In all cases the sac wall consists of the tunica propria of the kidney, into which the fibrous tissue of the ureter and renal pelvis is continued. Blood-vessels are not often very easily distinguished in the walls, but the renal vessels, though they atrophy, do not do so *pari passu* with the glandular substance of the kidney (Fig. 58).

The *size* of the hydro-nephrotic sac may not exceed the size of a normal kidney; it may be even smaller; or, on the other hand, it may be sufficiently large to form a tense irregularly

* *Ann. Surg. Phila.*, 1895, xxi. p. 695.

rounded swelling in the renal region, and may even occupy a great part of the abdominal cavity (Fig. 59).

In some instances the tumour extends as high as the costal margins, as low as the iliac crest, as far inwards as the median line or beyond it, and sufficiently far backwards to cause bulging of the loin. In exceptional cases the tumour attains such a size as to distend the whole abdomen, bulge out the lower ribs, and assume the appearance and physical characters of an immense ovarian cyst.

Dilated pelvis.

Lower pole of kidney.

Fig. 59.—Hydro-nephrosis forming a very large rounded tumour, consisting almost entirely of the renal pelvis. There is also a good deal of sacculation of the parenchyma. Nephrectomy. Recovery. Author's case. (Middlesex Hospital Museum.)

Sometimes adhesions form between the tumour and the parts around ; thus the peritoneum may be firmly united with the greater part of the wall of the cyst ; or the omentum, mesentery, pancreas, large intestine, liver, or spleen, may be firmly united to it ; and in long-standing cases a large quantity of fat may grow into the hilum (Fig. 60).

Histologically the first changes in the kidney are characterised by dilatation of the canaliculi and alterations in the shape of the epithelium owing to the pressure exerted upon it. There is also often considerable hyperæmia, and there may be some hæmorrhages into the interstitial tissue. The next change is the increase of con-

nective tissue, which renders the kidney very tough, and further damages its secreting substance.   The walls of the arterioles also become thickened and the circulation is impaired.   Lastly, atrophy of all the elements occurs and the kidney may be reduced to a mere shell.

The *fluid of a hydro-nephrotic cyst* is rarely like urine pure and simple.   Often it is odourless, gives no reaction with heat or nitric acid or with cupric tests, has a low specific gravity ;
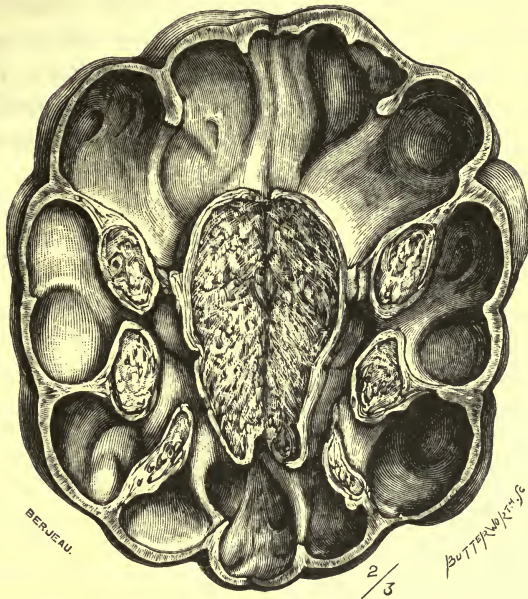

Fig. 60.—Sacculated Hydro-nephrosis, showing a considerable increase of fat in the hilum.   (Westminster Hospital Museum.)

leaves scarcely any residue on evaporation, and affords no evidence of urea or uric acid ; in fact, it is only water holding a large quantity of chloride of sodium in solution, and containing a few epithelial cells.   This has been the character of the fluid in several cases of congenital hydro-nephrosis, and in some acquired cases in which atrophy has advanced until the glandular substance has become entirely obliterated.   Experiments have shown that even a healthy kidney, if there be obstruction to the outflow of the urine, secretes a fluid which is deficient in urea, and, therefore, of very low specific gravity.   After ligature of the ureter, Ludwig has shown that the sodium chloride is the first salt to disappear from the fluid, by being absorbed into the blood ; this is followed by the sulphates and phosphates, and later on by the

uric acid and urea, but kreatinin may remain.   Dr. Dickinson remarks that if the dilatation, as often happens in double hydro-nephrosis, is common to all the urinary cavities, " their contents will be urine little changed, save that the specific gravity may be low, *as with urine secreted against pressure*, and it may have become ammoniacal." *   Uric acid, urates, and oxalate of lime may be found in the fluid ; at other times the contents of the cyst are turbid and mixed with muco-pus, or with blood-clot of old or recent date which gives a brown or red colour to the fluid. At others, again, urea and chlorides may be found in it in similar quantities as in natural urine ; and this, too, according to Prout, even in congenital hydro-nephrosis.   Epithelial and granular cells phosphates, and albumen, are frequent constituents.

Sometimes the contents are colloidal in character, as in Dum-reicher's case ; and in a case described by Dickinson the same " nasty stuff " had occasionally been passed *per urethram*.   In a case of hydro-nephrosis recorded by Dr. Coghill,† cholesterine was found in the fluid, so was it also, and in conjunction with a large quantity of albumen and 9 per cent. of urea, in a case recorded in the January, 1898, number of the *St. Mary's Hospital Gazette*. Mr. Hurry Fenwick exhibited to the Pathological Society of London (January 2, 1894) a hydro-pyo-nephrotic kidney in the fluid of which were crystals of cholesterine ; and in March of the same year Dr. Cecil F. Beadles showed a left kidney, embedded in the substance of which was a small cyst containing cheesy material and numerous cholesterine crystals.   Probably the presence of cholesterine in the kidney is less rare than is supposed, and is to be found in small renal cysts with clear fluid and in those which contain pus, and also in caseous foci within the organ.

The quantity of fluid contained in a hydro-nephrotic cyst is often enormous ; nine gallons, twenty-five gallons, and even thirty gallons (Glass) have been removed ; and in several cases sero-mucous, albuminous, or even well-nigh normal urine had drained away through a fistulous opening in the loin in quantities varying from four to ten ounces per diem.

Symptoms.—Hydro-nephrotic distension affects each kidney about equally.   It occurs at any period, from birth to extreme old age, and is met with also in the fœtus.   It is nearly twice

---

* *See* also case by Mr. Barker, in the *Lancet*, January 17, 1885.
† *Edin. Med. Journ.*, February, 1875, p. 747.

as frequent in females as in males. The duration of symptoms is very variable and in many cases extends over a number of years; thus in one case of a female, aged twenty-four, there had been pain and milky urine at intervals since childhood.

In cases in which the dilatation is insufficient to give rise to a tumour, there are generally no symptoms characteristic of hydro-nephrosis; it is simply a silent complication, or consequence, of some condition to which, and not to the insidious changes going on in the kidney, the attention of the surgeon or physician is called.

It must be borne in mind that the whole series of morbid changes described above may have occurred in the kidneys without there being any sign of an abdominal swelling. Out of forty-two cases of non-congenital hydro-nephrosis in which the renal changes were well pronounced, there was a palpable tumour in twenty-five; and in nineteen of these the tumour was unilateral, whereas in six it was double (Roberts). Out of the 381 Middlesex Hospital cases an abdominal tumour was clinically observed in but very few, though the atrophy of the renal tissue was very advanced in all.

In some advanced cases in which there is no tumour, symptoms are excited simply by the renal distension : these are pain in the back and along the course of the ureter, frequent micturition, and total or partial or intermittent anuria.

When the disease is bilateral, as in cancer of the uterus, uræmia may be looked for ; and though in many of these cases nothing can be made out from an examination of the urine, yet evidences of renal degeneration are seen in the dry and sallow skin, the aching loins, the nausea and sickness. When the pressure effects of cancer of the pelvic organs are associated with ulceration of the bladder, pyelo-nephritis and the symptoms to which it gives rise are found ; when simple obstruction by pressure is caused, and there is no ulceration of the bladder, hydro-nephrosis alone exists, and the symptoms referrible to the kidney are less marked.

Vomiting, convulsions, febrile symptoms, and coma are occasional phenomena.

Tumour.—When a tumour is formed, hydro-nephrosis has to be dealt with as a distinct disease, and on its own account; and more especially so when it threatens to damage neighbouring organs by its pressure, or to destroy life by bursting into the peritoneum, or in some other direction.

The tumour is dull on percussion, and is sometimes irregular or lobulated in outline, and frequently fluctuates. By its size it may cause much pain, displacement of viscera, disturbance of the action of the diaphragm, and thus of the lungs and heart ; and it is especially prone to interfere considerably with the action of the colon, thus inducing constipation.

If it arises from some innocent and painless cause, such as pregnancy or flexion of the uterus, its development is unattended by any constitutional or local disturbance ; but if from some condition such as impacted calculus or movable kidney, the symptoms incidental to the particular cause will occur before the tumour makes its appearance, and will probably mask the development of the swelling.

The enlargement has all the characters of a renal tumour, being situated in the flank, pressing forwards and outwards the parietes, causing fulness in the ilio-costal area, having the colon in front of it, and the small intestine either in front or thrust over to the opposite side of the abdomen, according to the bulk of the swelling.

Dr. Dickinson estimates that in about one-fourth of the cases of single hydro-nephrosis in which a swelling is observed during life, the tumour extends beyond the median line of the body, and that in one-third of these it has at length occupied the greater part of the belly.

In Mr. Glass's case, by far the largest yet recorded, the belly of the patient (a tall, well-proportioned woman of twenty-two) measured six feet four inches in circumference, and the cyst held thirty gallons of fluid ; the heart was pushed up to the clavicle, and the lungs by compression were reduced to the size of those of a new-born child.

Pain.—It is often stated that a hydro-nephrotic tumour is quite painless, and so it may be when not of any great size. But on the other hand, when the tumour is large, the pain may be of the most agonising character, as agonising as the pain of unrelieved retention of urine in the bladder, or even more so.

In some cases the sufferings amount to the most severe torture, and the writhings of the patient are terrible to witness.*

---

* *See* case related in my "Surgical Diseases of the Kidney," 1885, p. 311 *et seq.*

A hydro-nephrotic sac may rupture into the peritoneal cavity and give rise to severe pain for several days before death ensues. Such a case has been recorded by Hebb in the *Transactions* of the Pathological Society (vol. xlviii.). The patient, a man aged fifty-three, was admitted into hospital for pain in and enlargement of the abdomen. Some fifteen to twenty years before he had had a severe blow on the left flank, since which occasional attacks of pain had occurred, but he was able to work up to within fourteen days of admission, when he was seized with severe pain in the abdomen and felt something give way in the left side. He vomited, and from this time the abdomen began to swell. After death many pints of reddish-brown fluid were found in the peritoneal sac, escaped from the left kidney, which was converted into a cyst with secondary cysts representing the pelvis and calyces. There was a rupture of the wall communicating with the peritoneal sac at the junction of the ureter and pelvis. The ureter was dilated and sacculated and was occluded by adhesive fibrosis of its wall about one inch from the bladder. It contained a small oval calculus, quite free, weighing 67 grs., and composed of oxalate of lime.

Intermittence.—The symptom of intermittence is one which gives a very important character to certain hydro-nephrotic tumours (and pyo-nephrotic and hæmato-nephrotic tumours also).

In March, 1876 (*Trans. Roy. Med.-Chir. Soc.*), I recorded a case of intermittent hydro-nephrotic tumour due to a papilloma of the bladder; there were portions of the growth in connection with both ureteral orifices, but the hydro-nephrotic kidney was hypertrophied, the other was atrophied. At the same time I published a table of six other cases of intermittent hydro-nephrotic tumours due to different causes. I have since seen other cases in which the tumour has been intermittent and in which the hydro-nephrosis has occurred in non-movable kidneys. I believe Dr. Cole of Bath, in 1874 (*Brit. Med. Journ.*), to have been the first to give the distinguishing name " intermittent " to certain cases of hydro-nephrosis; Dr. Cole considered the cause in his case to be an oxalate of lime calculus in the renal pelvis. Certainly it was from Dr. Cole's paper that I adopted the term. It is interesting to me, and only just to Dr. Cole, that I should refer to this, because Albarran in his recent admirable treatise (" Maladies du Rein ") states (and so far as English

writers go erroneously states) that Landau " created the type
of intermittent hydro-nephrosis which he attributed to movable
kidney." He then refers to me and others as following Landau,
and controverts the theory of Landau on the double ground
(1) that the variations in size of movable kidneys are often due
to states of congestion of the organ and not to the accumulation
of urine within the renal calyces and pelvis ; and (2) that inter-
mittent hydro-nephrosis is not always due to mobility of the
organ but to other causes, such as renal calculus and tubercle,
and stricture and stenosis of the ureter. Had Albarran read
my paper in the *Medical Chirurgical Transactions*, he would
have found cases due to these various causes there quoted in detail.
Moreover, the date of Landau's work is July, 1881, more than
five years later than my paper and seven years after Dr. Cole's
article in the *British Medical Journal*. Terrier and Baudouin
collected eighty-three cases of intermitting hydro-nephrosis and
found that the most usual cause of this special form of the
affection was a floating kidney causing a kink in the ureter.*

There is good reason to think that the varying degrees of
tension with which this feature—intermittence of distension—
is associated explains the alternation of local ease and suffering
which many patients experience even when there is no appreciable
renal tumour. When the renal distension amounts to a clinical
tumour, then the patient and the medical attendant find that
there are days and times when no tumour can be found, and others
when the tumour is quite prominent. With the occurrence of
the swelling there are pain and scanty urine ; as the tumour
subsides, the pain ceases, and an increased discharge of urine
from the bladder will soon follow.

Intermitting hydro-nephroses in which a tumour is prominent
at one time and not distinguishable at another are not very
uncommon ; in many others the tumour diminishes from time
to time without actually vanishing. Dr. Roberts says that this
happened in nine out of the twenty-five cases collected by him,
in which the existence of a tumour was clinically ascertained.
In most of such cases the subsidence of the swelling is followed
by the discharge *per urethram* of an increased quantity of urine,
and when this can be proved to occur we obtain a most
important diagnostic sign of hydro-nephrosis. There is usually

* *Annual of the Universal Medical Sciences* E. 28.

considerable pain before the onset of the swelling and relief usually precedes its complete disappearance.

The urine during the increased flow is usually of a lower specific gravity than normal and occasionally there may be an admixture of blood, pus or mucus, but these complications are very rare in those cases which do not depend upon the presence of papillomata or calculi. At other times, and in cases which do not subside or intermit, the urine gives no information whatever.

The characters of the urine secreted by a hydro-nephrotic kidney have already been described. When only one kidney is involved, the urine passed by the patient may have nothing abnormal about it, and beyond a somewhat low specific gravity it may be quite natural.

Hæmaturia.—It must be remembered that hæmaturia, sometimes, though very rarely, copious, may be a symptom in hydro-nephrosis. It was so in the case of a boy, aged seven, who was under my care in 1893, and from whom I removed a hydro-nephrotic kidney, as related in the *Lancet* (January, 1894, p. 205). Allingham* has reported a case, and others have been published by Israel, Reclus, and Albarran.

Diagnosis.—Hydro-nephrotic distension has to be diagnosed, when of moderate size, from renal abscess, perinephric abscess, and perinephric extravasation. When it forms a palpable tumour it may be mistaken for pyo-nephrosis, or for a hydatid or serous cyst of the kidney, liver, or spleen; and when of very great size so as almost to fill the abdomen, it is most likely to be mistaken for an ovarian cyst or for ascites. If there is hæmaturia with hydro-nephrosis, the question of malignant renal new growth may arise.

There is one sign which when it occurs is almost conclusive of hydro-nephrosis, and that is the subsidence of the tumour, followed by an increase in the outflow of urine; but this very often does not occur; and we have, therefore, to rely on other symptoms.

Renal abscess and *perinephric abscess* are more acute in their course, and excite much more pain and constitutional disturbance in their onset and early part of their progress, certainly before any lumbar or abdominal swelling exists.

Perinephric abscess causes fulness in the loin, tending to spread upwards and downwards, but does not present a circumscribed more or less movable tumour coming forwards in the

* *Med. Press and Circular*, 1892, vol. ii.

abdomen, and felt, as the patient lies on his back, to be passing beyond the umbilicus. There are often œdema and redness of the skin of the loin in perinephric abscess, but not so in hydronephrosis, at any rate not until after the tumour has reached too large a size to be mistaken for perinephric abscess. In perinephric abscess the matter may burst in the loin or at or below Poupart's ligament, but is not likely to point higher up in front ; in hydronephrosis redness and superficial fluctuation are sometimes felt at a spot on the side, or towards the front of the belly.

Perinephric extravasation.—After an injury to the loin or renal region, it may be a question whether a tumour in this situation is a collection of urine within the calyces and pelvis of the kidney due to occlusion of the ureter by blood-clot or partial laceration of its coats ; or is a circumscribed collection of urine and blood in the perinephric tissue due to a more or less complete rupture of the kidney or its pelvis. In the latter case the swelling will attain a considerable size in a short time, because the kidney, being displaced and not compressed from within, will offer less obstruction to the secretion and outpouring of urine than when the dilatation is of the kidney itself. The swelling, though to an extent circumscribed, is likely to be much less defined and limited in front, and more diffused behind, above, and below, than a hydro-nephrotic swelling.

Pyo-nephrosis.—Between hydro-nephrotic and pyo-nephrotic tumours the diagnosis is often impossible. If the urine is or has been distinctly purulent, and if rigors, feverishness, and other indications of suppuration have preceded and accompany the swelling, then pyo-nephrosis may be diagnosed. But in many cases of pyo-nephrosis these symptoms are wanting ; moreover, a hydronephrotic sac may suppurate quietly, and thus pass by degrees into a pyo-nephrotic tumour. Either may be completely closed against the bladder.

Hydatid and serous cysts of the kidney will best be diagnosed by their history. Is there or has there been any cause of obstruction ? If so, the swelling is in all probability hydro-nephrotic. Hydatid of the kidney is often secondary to, or associated with, hydatid of liver. If a hydatid vesicle has escaped with the urine, the diagnosis is clear ; but this aid is not always forthcoming.

In hydatid of liver or spleen the tumour bulges less into the loin, and more towards the front of the abdomen, or upwards

against the diaphragm, than a renal tumour ; it is continuous with the liver or spleen ; moves more decidedly and freely in a vertical direction during respiration, and is moved less freely by palpation from side to side. Even if, as may be the case, there is resonance over a great part of the front surface of a hydatid cyst of the liver, the extent of the anterior limits of the tumour, together with the absence of fulness in the loin and of the other symptoms mentioned above, will generally suffice to exclude hydro-nephrosis. A hydro-nephrotic cyst may contain large quantities of crystals of cholesterine, and if it forms a large tense tumour passing up under the ribs and occupying the epigastric and umbilical, as well as the right hypochondriac and lumbar regions, it may very possibly, even after tapping, be mistaken for a hepatic hydatid cyst, unless the fluid is tested for urea, which possibly may be found present in fair quantity, although its absence or presence in minute amount would go for nothing.

Where the tumour is of great size, hydro-nephrosis is most likely to be mistaken for ovarian tumour. This error has been many times committed. Out of twelve cases of hydro-nephrotic cysts in women which I collected in 1876, no less than seven had been diagnosed as ovarian, and no less than five of the seven were submitted to abdominal section on the strength of this wrong opinion. I think it highly probable that a great many of the tumours which have been diagnosed as ovarian, but which, nevertheless, have spontaneously vanished, were hydro-nephrotic in their nature, and disappeared by the discharge of the urine through the natural channel; though it must be borne in mind, as has been pointed out by Wilson,* that ovarian cysts may also occasionally intermit, and the process be accompanied by profuse diuresis.

With care, however, an ovarian tumour will be excluded if attention be paid to the direction of the growth of the enlargement, to its relation to the colon, and to the evidence afforded by a vaginal and rectal examination. I have seen an ovarian cyst even after removal very closely simulate a hydro-nephrosis. The diagnosis had been very difficult, and when the cyst had been excised the Fallopian tube was found adherent to its wall, and communicating with its cavity. It resembled a hydro-nephrotic kidney with a dilated ureter.

* Thomas Wilson, *Annals of Surgery*, May, 1897.

When the tumour is renal the uterus is neither displaced nor fixed, and there are generally some symptoms referrible to the urinary organs. A renal cyst is rarely so mobile as many ovarian tumours are. The large intestine can generally be detected in front of a hydro-nephrotic cyst ; sometimes it may be even rolled between the cyst and the fingers on the front of the abdomen ; or gurgling and the sensation of flatus may be detected. A caution is needed respecting the relation of the colon ; occasionally, and especially when the tumour has attained a great size, the colon gets behind the bulk of the tumour, whereas on the other hand a portion of the intestine is in some cases found in front of an ovarian tumour.

If with the fingers in the vagina or rectum a calculus or some other cause of ureteral obstruction can be made out in the lower end of the ureter, the diagnosis would be assisted and the cause of the hydro-nephrosis explained. The relation of the tumour to the uterus and ovaries should be ascertained by vaginal or rectal examination, and the examination is assisted by pressure with the other hand upon the front of the abdomen at the same time.

When the renal dilatation is very considerable, and the attenuation of the cyst very extreme, fluctuation may be so general and so superficial that ascites may be thought to exist, as in Dr. Hillier's case.* The character of the fluid, if withdrawn by aspiration or tapping, will correct such an error, as it will probably have a urinous odour, and may contain urea and uric acid. Ascites may, however, co-exist with hydro-nephrosis as with any other solid or fluid growth within the abdominal cavity.

The **prognosis** depends much upon the cause of the distension, but chiefly upon whether one or both organs are involved. If only one kidney is affected the other can do duty for both, and life may be indefinitely prolonged, provided the size of the tumour is not great, or relief from distension is afforded in good time. If the distension increases, and is unrelieved, death will result from the effects of pressure on neighbouring organs, from rupture into the peritoneum, or from suppression of urine or uræmia. Traumatic rupture of the cyst has been the termination of several reported cases. Simon mentions four cases of this kind. Spontaneous rupture into the peritoneum is not, however, a frequent

* *Med.-Chir. Trans.* vols. xlviii. and lii.

occurrence ; Roberts found it only once in nineteen fatal cases.   Taylor* records a case in a girl, aged fifteen, of acute hydro-nephrosis which ruptured into the peritoneal cavity, but which was successfully treated by laparotomy· in the median line, and stitching the cyst walls to the abdominal opening.   All the urine from the kidney (left) in this case came by way of the fistula.   In most cases where the distension affects both kidneys, the fatal result is brought about by the destruction of their glandular substance, and the gradual cessation of the renal function.

In some cases the tumour has spontaneously subsided and never returned ; this was the termination in six cases out of a total of forty-seven of hydro-nephrotic tumours which I collected many years ago ; in a seventh case where the tumour intermitted many times, it at length subsided, and had not re-appeared when the patient was heard of a long time afterwards. If the tumour is small and does not increase, there is no tendency for it to be directly causative of death ; but there is always the fear lest a calculus or some affection of the opposite kidney may supervene and lead to a fatal issue by suppression of urine or by uræmia.   When the ureters and calyces of both kidneys are dilated as a result of stricture, enlarged prostate, vesical growths, etc., operations upon the lower urinary organs are full of risk to the patient, owing to the great liability of inflammation spreading up the ureters, and ending in diffuse suppurative pyelo-nephritis.

Treatment.—In considering the treatment of hydro-nephrosis, it is as well to bear in mind that these swellings may (1) intermit ; (2) subside entirely and never recur ; (3) subside partially but not quite disappear, or (4) suppurate and after suppurating may undergo either of the changes just mentioned.   Several instances of each of these conditions are tabulated in my paper in the *Med.-Chir. Trans.* (vol. lix., 1876).   The great majority, however, never either intermit or subside.   An intermittent hydro-nephrosis after refilling and subsiding many times may at length subside and never recur : this was the termination of the tumour which had existed off and on for four years in Dr. Cole's case.   It should also be remembered that many hydro-nephrotic kidneys do not give rise to a tumour, yet cause pain, possibly hæmaturia, and in some cases occasionally large discharges of urine ; and if these kidneys were surgically treated in good time, the organs

* *Lancet,* October, 1884.

would be prevented from becoming entirely destroyed, and many of them would be capable of regeneration to a great degree. The treatment of hydro-nephrotic tumours is purely surgical; nothing can be done for them by medicinal remedies. When they cause trouble either by their weight, pressure, or size, the aspirating needle may be employed, if there is any reasonable ground for believing that the obstruction is temporary, and that a reaccumulation is not likely to recur; but this is rare.

Massage.—Attempts have been made to overcome the obstacle to the passage of urine by *friction*. Two cases at least are on record in which the tumour subsided after manipulation (Roberts' and Broadbent's). In Roberts' case the tumour was rubbed in every direction with a lubricating ointment every other morning, and after the third application the patient, a girl, aged eight, suddenly passed a large quantity of urine, and the swelling forthwith subsided and did not return. In Broadbent's case a child three months old, whose abdomen had been large from birth, though urine had been passed in usual quantity, had an enormous tumour which disappeared after friction with iodine ointment. The child, however, subsequently died. Probably this treatment, which was thought to answer well in these two cases, was suggested by a third case reported by Mr. Thurnam in 1837. A little boy, four months old, had a lobulated tumour from alternate dilatations and contractions of the whole length of the ureter; the mother of the patient was in the habit of rubbing it with her hand to relieve pain, and when she did so she noticed the child's bladder swelled up as large as an egg.

I have on several occasions known a hydro-nephrotic cyst to disappear, or diminish markedly in dimensions, after palpation in the course of a bedside examination; but there is no curative tendency in thus fortuitously emptying the cyst. Moreover, the treatment by manipulation is not free from risks, and cannot always even be tried, either because the tumour is far too painful to allow of it, or because the degree of distension would make the risk of rupturing the cyst wall too great.

Tapping.—Aspirating the tumour may effect a complete cure either by relieving pressure or by releasing torsion of the ureter. Sometimes recovery occurs after a single tapping, as in Dr. Coghill's case,* in which an exploring needle let out four pints six ounces

* *Brit. Med. Journ.*, February 6, 1875.

and a half of straw-coloured fluid, and the patient, a lady, aged thirty, recovered.

In Croft's * case of hydro-nephrosis, in a boy, aged twelve, occurring forty-nine days after an injury, the tumour was tapped eight times within three months; between three and four pints were withdrawn on each of seven occasions, thirty-eight ounces of urinous fluid were removed on the eighth occasion, and after this there was no subsequent reaccumulation, and the cure was complete. The obstruction was probably due to a clot.

Recovery after a single tapping is rare; as a rule, repeated tappings are requisite. Of eighteen cases treated by simple puncture, ten were cured, five died, and three were relieved; but in more than one of the fatal cases further treatment ought to have been adopted, and if it had been, there is little doubt that these cases might have been removed from the list of deaths into a list headed "unrelieved by puncture, but cured by incision."

It must be expected, if aspiration, or the trocar and cannula are employed, that the cyst will repeatedly refill, or that suppuration may possibly occur; in either event, nephrotomy and drainage, or nephrectomy will be required. Uræmia, erysipelas, perinephritis resulting in inguinal abscess, and œdema of the lungs, have caused death after puncturing. When the puncture has been made far forwards, death has been hastened by peritonitis due to the escape of fluid from the cyst into the peritoneum. In one or two instances in which the puncture treatment has been employed death occurred, long subsequent to the last puncture, from spontaneous rupture of the cyst, a termination which would have been prevented by lumbar nephrotomy or nephrectomy. Puncture, followed by the injection of iodine, tincture of iron, or other fluid intended to excite adhesion or contraction of the cyst walls, is dangerous, and hitherto has been utterly futile. I know of no case in which the practice has been successful, though it has been several times tried.

Puncture with a large trocar and cannula, followed by the retention of the cannula, is the oldest method of drainage; but it is imperfect, and not comparable with nephrotomy followed by the stitching of the cyst wall to the parietes of the loin.

In the absence of any very distinctly fluctuating area where the skin is discoloured or the sac thin, no better spot can be

* *Clin. Soc. Trans.*, vol. xiv. p. 107.

selected, if the tumour be of the left kidney, than one just an-
terior to the last intercostal space ; but if the tumour be of
the right kidney this is too high, as the liver in all probability
would be traversed.   I have on several occasions tested the truth
of this statement in the post-mortem room, and in only one
experiment did the liver escape ; in this single instance it was
very small and markedly distorted from cirrhosis.   In one case,
that of a young person with healthy viscera, whose death had
been caused by a fall, the liver was considerably displaced up-
wards by effused blood ; but in spite of its upward displacement
it was transfixed by the needle three-quarters of an inch above
its right free edge.

In no instance was the spleen punctured by inserting the
needle in front of the eleventh intercostal space on the left side.

If there be no indication for operating elsewhere, the best
spot to select, when the tumour is of the right kidney, is one
half way between the last rib and the crest of the ilium, between
two inches and two inches and a half behind the anterior superior
spine of the ilium.   This spot is on a level with the front of
the bodies of the lumbar vertebræ, and a needle here passed
horizontally inwards will be altogether in front of the normal
kidney, and will either transfix or pass in front of the ascending
colon when in its usual place.   It may, however, with safety
be conjectured that in any case of hydro-nephrosis of the right
side *requiring to be tapped,* if the trocar be inserted at the spot
I propose, and directed somewhat forwards, the peritoneum and
colon will be sufficiently in front to escape injury, and the liver
will be safely out of reach above, while the dilated kidney will
be tapped at its anterior and lower part.

Cauterisation of the abdominal walls to excite adhesions be-
tween the parietes and the cyst prior to nephrotomy or to draining
with a cannula, is unnecessary, tedious, and fraught with danger.
Peritonitis and septicæmia have followed, and caused death.

Nephropexy.—If the hydro-nephrosis is the result and not
the cause of movable kidney, nephropexy may suffice.   But no
case should be treated in this way without first making a careful
examination of the superior ureteral orifice, and testing the patency
of the ureter by means of the ureteral bougie passed from the
renal pelvis into the bladder.   Even in cases in which the mobility
of the kidney and the consequent kinking of the ureter have

been the cause of the hydro-nephrosis, the normal relation of the ureter to the renal pelvis may have become permanently altered, or the kinking may have been made permanent by perinephric adhesions, so that the mere anchorage of the kidney will not give relief to the obstruction.

Catheterisation of the ureter from the bladder upwards has been recommended and practised by a few surgeons in cases of stenosis, valves, curves and strictures of the ureter when the channel for the urine is only partially occluded ; but it is not a plan of treatment which ought to be, or which can be frequently employed ; it should not be attempted in the great majority of cases, and never, even in the exceptional ones, save by an expert with the ureteral catheter.

It is admitted that the only cases of hydro-nephrosis which are suitable for ureteral catheterisation are just those which are most suitable for lumbar puncture, or for treatment by the aspirator or trocar and cannula. The puncture has the advantage over the ureteral catheter that asepticity can be more certainly secured and thus the danger of infecting a hydro-nephrotic sac can be more completely avoided ; it is much easier of performance and more certain to empty the cyst ; it is not so painful and unpleasant to the patient, who, if a woman, is caused a good deal of distress by the manipulations and inspection of the bladder in an objectionably exposed posture.* Further, it must be remembered that abrasions followed by contraction of the vesical orifice of the ureter have been caused by the catheter in some cases in which this treatment has been tried for hydro-nephrosis from valves or curves in the ureter; also that, though a bougie most readily passed upwards from the bladder to the kidney, the urine was prevented from passing down to the bladder ; and lastly that in cases in which a hydro-nephrotic cyst has been emptied and for the time apparently cured by the ureteral catheter, relapses recur and the tumours have again refilled owing to the subsequent contraction of the ureteral stricture or re-formation of the ureteral curve.

Nephrotomy.—Putting aside, therefore, massage, ureteral catheterisation and puncture as either unsafe or too uncertain, I would summarise the treatment of every case of hydro-nephrotic tumour, and of every case in which though there is no tumour the other symptoms point to hydro-nephrosis, as consisting first in making

* See the illustrations in some recent works on gynæcology.

an exploratory lumbar incision on the affected side and examining
the kidney and ureter in the manner detailed in the chapters on
operations; and secondly in removing the cause of the obstruction.

The exact procedure must then depend upon the condition
found : (1) *The obstacle if possible should be removed.* If a calculus
in the renal pelvis or ureter, or a valve, stricture, or stenosis of
the ureter is present, this can be done by pyelotomy, ureterotomy, or
a plastic operation. If the obstruction is near the bladder uretero-
vesical grafting may possibly be indicated. (2) If the obstacle can-
not be removed and the opposite kidney is absent or diseased, lumbar
nephrotomy must be performed and a permanent fistula established.
(3) If the obstruction is one which is likely to be of only tem-
porary duration, or which cannot be removed at the time of
the lumbar exploration because of the state of health of the
patient, or if the condition of the opposite kidney is unknown, then
nephrotomy with drainage is the proper operation. Secondary
nephrectomy can be performed at any subsequent period if
necessary. (4) If the renal parenchyma has been destroyed past
secreting to any useful degree, and if the general state of health
of the patient and the known condition of the opposite kidney
warrant it, then primary nephrectomy is the only proper thing
to be done. This operation has been in my own hands and
those of others most successful for hydro-nephrosis when per-
formed in the manner I have recommended and practised for
many years past (*see* Vol. II., p. 260).

If nephrotomy with the view of establishing a permanent
fistula, or nephrotomy as a temporary expedient, is performed,
the edges of the cyst should be stitched to the edges of the wound
in the lumbar parietes. If the lumbar incision is made high
and carried far enough forwards, plenty of room is obtained, so
that the cyst wall can be readily drawn up into the loin wound.

Drainage and antiseptic irrigation are effected by means of
a large rubber tube, which should be fixed in the cyst, and weak
Condy's fluid, thymol, or weak carbolic acid in solution should
be passed through it daily, if requisite, to keep it aseptic.

This practice has been very successful, and ought certainly to
be adopted unless the surgeon is quite sure about the soundness
of the opposite kidney, before nephrectomy is entertained, provided
of course that there remains any secreting renal parenchyma and
that the cyst wall is not simply a fibrous or calcified membrane.

Nephrotomy has given me a most excellent result in a case in which I operated upon the right kidney, which was movable and hydro-nephrotic, for Dr. Knight of Brixton in 1893. Four years before this date I had removed the left kidney of the same lady for hydro-nephrosis (see Fig. 52, p. 405). The case is reported in full in Dr. Knight's able thesis on "Movable Kidney and Intermitting Hydro-nephrosis" (1893). This lady was alive in July, 1899, and Dr. Knight, then kindly replying to my inquiries, wrote: "After all these years Miss S. continues in good health. The menopause has passed two years. The fistula still remains open, but the quantity of urine passed by it has diminished during the last few years, until now it rarely exceeds two ounces per diem; and a good quantity of healthy urine passes naturally from the bladder. I saw her so that I might give you the latest report, and I think she looks well and healthy, and has every probability of reaching a good old age." The later history of this case tends to show that such a change may take place gradually, after fixing the kidney to the loin, that, though at first all the urine escapes by the fistula, it may by degrees come to find again its natural exit through the bladder.

In Taylor's * case, in which, after rupture of a hydro-nephrotic cyst into the peritoneum, the abdomen was opened, the peritoneum cleared of the urine, and the cyst wall stitched to the opening in the parietes, the patient made a good recovery with a permanent fistula, which, however, did not drain nearly so perfectly as it would have done through a lumbar opening.

Nephrectomy.—When a fistula remains in the loin after nephrotomy and the fluid is very purulent or offensive, or what remains of the renal tissue is incapable of performing the proper function of the kidney, the patient runs risks from the continuance of such a sinus, and cannot derive any benefit from retaining such a useless remnant of the kidney. Lumbar nephrectomy should in such a case be performed.

The method of nephrectomy for hydro-nephrosis is by the lumbar incision. The cyst wall, having been reached, is punctured and the contents are drawn off. As the fluid flows away, the sac is gradually withdrawn through the wound and the cellular tissue peeled off from it as it is withdrawn. The detachment of these adhesions is easy and simple if care is taken not to begin the

* *Lancet*, October, 1884, p. 589.

enucleation till the sac is actually reached. The cyst comes away just as in ovariotomy. The pedicle is then ligatured in the usual manner, and the wound closed. No fistula results, and recovery is uninterrupted.

II. Congenital Hydro-nephrosis.

By congenital hydro-nephrosis is meant hydro-nephrosis in the fœtus and new-born ; not hydro-nephrosis which occurs some time after birth and is due to a congenital cause.

In by far the larger number of cases of congenital hydro-nephrosis both kidneys are involved ; but this is not always so. When one kidney only is affected, the obstruction will have been caused by some abnormality of the corresponding renal artery ; or some obliquity, contraction, or actual occlusion of the ureter. Adler[*] describes the case of a child, aged three and a half, who had suffered pain in the left side for a year and a half, and whose abdomen was entirely occupied by a large tumour. This was opened and the edges sutured to the skin, 650 cm. of fluid being removed. Subsequent complications necessitated nephrectomy, when the congenital origin of the condition was shown by the abnormal arrangement of the colon, the nearly horizontal direction of the ureter, and a fan-shaped distribution of the renal vessels.

Congenital strictures of the ureter are sometimes a cause of hydro-nephrosis, as in a case recorded by W. W. Ord in the *Transactions* of the Pathological Society (vol. xlvi.), in which a hydro-nephrosis was due to an apparently congenital stricture at the upper part of the ureter, at the point of its exit from the pelvis of the kidney. The case occurred in a boy, aged one year. In the famous case cited by Bonetus in the " Sepulchretum "[†] an evident tumour of the right kidney was produced by complete occlusion of the ureter. Billard [‡] has recorded the case of a male child who had a large rounded hydro-nephrotic tumour in the left lumbar region due to malformation of the ureter. Towards the bladder the ureter terminated as usual, but above it formed two small thin impervious cords, which joined the renal pelvis by a number of filaments resembling a goose's foot. The

[*] *Deutsch. Med. Wchnschr.*, 1894, xx., p. 151.
[†] Tome ii., p. 290.
[‡] " Traité des Maladies des Nouveau-nés," p. 434.

right kidney was somewhat larger than normal, and contained turbid urine and a large quantity of sand-like calculous matter. The infant lived one month.   Cruveilhier mentions a case due to congenital absence of the ureter.   Cockburn has recorded in the Pathological Society's *Transactions*, vol. xlviii., a case of hydro-nephrosis in a child of five weeks, due to pressure on the ureter by a congenital cystic tumour of the pelvis, of uncertain origin. Reliquet has published a case * in which the cause was a cyst compressing the ureter, and developed near the bladder in a vestige of the canal of Müller.

When both kidneys have been involved, the most common cause has been imperforate urethra ; this malformation may be a mere membranous septum at some point, or a more or less complete absence of the urethra without any communication with the bladder. Lamotte recorded a case in which a thin membrane situated at the vesical orifice of the urethra and producing hydro-nephrosis, was readily broken down on passing a sound.   Billard † has described the case of a still-born male in whom there was only about an inch of urethra extending from the end of the penis to the front of the perineum ; an internal orifice of the urethra did not exist.   The rectum ended in a *cul-de-sac* adhering to the bladder ; there was no anus, and only a very doubtful representative of a prostate gland.   Howship ‡ gives the description of three cases in which the cause was imperforate urethra.   Dr. Kennedy § exhibited to the Dublin Pathological Society the body of a new-born infant with enormous distension of the urinary organs due to obstruction of the urethra.

In an instance of a still-born child (male) brought under my notice by Dr. George Roper, and which I dissected, the kidneys, ureters, and bladder were all greatly distended, and the only ascertainable cause was a small cyst in the mucous lining of the membranous urethra.   This cyst did not quite fill the lumen of the urethra, but being situated on the floor of the passage, it formed an effective barrier to the outflow of urine.   It was one of the mucous follicles of the urethra much enlarged.

Torsion of the penis is a congenital cause.   The accompany-

* *Progrès Med.*, 1877.   No. 11.
† "Traité des Maladies des Nouveau-nés."
‡ "Treatise on Diseases of the Urinary Organs."
§ *Dublin Journ. Med. Sciences*, 1840.

ing figures illustrate a case of this sort, which I had under my care in 1893, and published in the *Lancet*, June 8, 1895 (p. 1435). The case is of interest because the infant (a male) was operated upon within twenty-four hours of its birth, a urinary fistula being established in each loin, and the child's life thus prolonged for ninety-four days.

In another case, the details of which I published in 1876,* the cause of the obstruction could not be ascertained, but there was no reasonable ground for doubting that it was either such
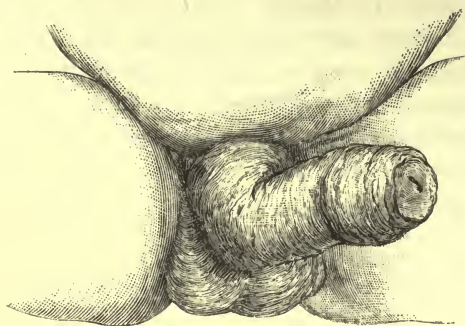
Fig. 61.—Torsion of the Penis, which caused double Hydro-ureterosis and Hydro-nephrosis. (Reproduced from the author's work on "Injuries and Diseases of the Genital and Urinary Organs." 1895.)

a cyst as in the case just mentioned, or else a thin, easily broken-down membranous septum in the urethra.

Cases in which no stricture or other cause of obstruction has been found are recorded by Braxton Hicks,† Gervis,‡ Smellie, Honerkopff, and Dr. A. R. Simpson.§

In each of these cases the seat of the obstruction, whatever its cause, must have been at the vesical orifice of the urethra or altogether in front of the bladder. It was most likely some slight obstacle which was overcome on the introduction of a bougie, without being noticed, or by the pressure to which the fœtus was subjected during parturition.

Any cause, such as intra-uterine pressure in the urethra or bladder, preventing the discharge of urine, which goes on naturally during the later months of intra-uterine life into the sac of the amnion, may give rise to congenital hydro-nephrosis.

* *Lancet*, vol. i. The case was read before the Royal Med.-Chir. Society.
† *Trans. Obstetrical Soc.*, vol. v.   ‡ *Ibid.*, vol. vi.
§ *Glasgow Med. Journ.* (new series), vol. ii. p. 336.

It is quite possible that tonic spasm of the urethra or sphincter of the bladder may be the cause of double congenital hydro-nephrosis in some cases. In support of this view there is the undoubted fact that *spasmodic* muscular action occurs in the fœtus *in utero* to such a degree as to cause many
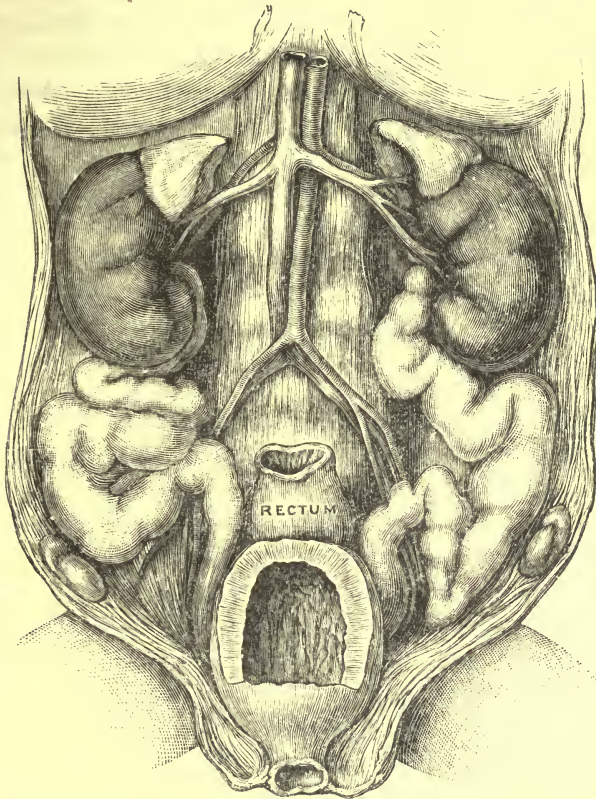

Fig. 62.—Dissection showing condition and position of the Ureters and Kidney. From a child (the same as in Fig. 61) upon whom a double lumbar operation was performed within 24 hours after birth.

congenital deformities, such as club-foot, congenital dislocation, wry-neck, etc.

It is certain that in some cases of congenital double hydro-nephrosis the cause has resided in both the ureters. Braxton Hicks recorded a case of enormous distension of the abdomen of a fœtus, which impeded labour and necessitated the use of the crotchet. The abdominal distension was due to double hydro-

nephrosis from obstruction of each ureter. Broadbent [*] has published a case, in which the obstruction affected both kidneys of a female infant, and was due to valves of the mucous membrane near the pelvis of each kidney. Lee reported a case in a female in which the cause was impervious ureters.

The period over which congenital hydro-nephrosis extends varies. In many cases the fœtuses are born dead, sometimes before the completion of the full period of gestation. In other instances the children are born alive, but die within a short period after birth, viz. from a few hours to three or four months. In Broadbent's case the tumour subsided after friction, but the infant died when between three and four months old. Faber's case (a male) died from a fall when five and a half years old ; he had been ventricose from birth. Lamotte's case seems to have survived ; for though no urine was passed and a large abdominal tumour existed, yet urine escaped, and the swelling entirely vanished after a membranous obstruction in the urethra had been broken down.

The character of the fluid in congenital hydro-nephrotic cysts.—The urine removed from cases of congenital hydro-nephrosis varies considerably in its composition, and in some cases contains little or no urea. In the specimen supplied from Hay's case Prout found at first only faint and somewhat doubtful traces, but after the fluid had stood several days these became distinct. An acid principle was also detected, which Prout thought somewhat resembled the allantoic in some of its properties, though it differed from it in others. In Kennedy's case, no trace whatever of urea could be found in the fluid removed either from the bladder or kidney, notwithstanding a most careful analysis. In a case of fœtal hydro-nephrosis reported by Madge [†] the fluid contained in the renal sacs had no urinous odour on boiling, and unsuccessful attempts were made to find urea and uric acid in it. The fact that such a condition as congenital hydro-nephrosis is possible, proves that the secretion of urine goes on to a very considerable extent during the latter half of intra-uterine gestation, and that when any obstacle to the outflow of urine exists, the same pernicious effects of distension of the bladder, ureters, and kidneys occur

[*] *Path. Soc. Trans.*, vol. xvi., p. 164.
[†] *Obstet. Soc. Trans.*, vol. xi.

before birth as are commonly known to arise from urethral stricture, calculus, and other causes of obstruction after birth.*

A special point of interest connected with these cases is the frequency with which they are associated with other congenital deformities and malformations. Hare-lip, club-foot, some abnormality of the anus or intestine, or some malformation of the external genital organs, has often been found in the subjects of congenital hydro-nephrosis. In Simpson's case the feet were clubbed; in Hay's case (reported by Lee), a still-born hydro-nephrotic female infant had impervious ureters, double hare-lip, and two clubbed feet. In Billard's case, a still-born male had many defects of development in rectum, urethra, and prostate. In one of Howship's cases, a male infant born alive at the eighth month, the feet were distorted, the anus imperforate, and the lower part of the belly was occupied by a large circumscribed tumour. The child died the same evening; the kidneys and ureters, as well as the bladder, were found excessively distended by urine; the bladder, though it had attained an extraordinary degree of thickness and strength, had given way posteriorly, where a large cyst or pouch was formed; and the natural structure of the kidneys had entirely disappeared.

In my own case, referred to above, there was an absence of part of the rectum, and a *cul-de-sac* in place of an anus.

It has been chiefly, though not exclusively, with double congenital hydro-nephrosis that these various malformations have been associated. The frequency of this association is of importance to the practical surgeon, as well as of interest to the pathologist; for when considered side by side with the fact that malformed and misplaced kidneys are also often associated with such malformations, it teaches us to suspect renal imperfections, and to be careful before undertaking nephrectomy, in one who has *any* visible or ascertainable defect or error of development.

Lastly, an important practical point which must not be forgotten is that the size of the abdomen of a fœtus affected with hydro-nephrosis is often a serious impediment to labour, and may under some circumstances render parturition impossible until some means have been taken to reduce the volume of the child.

* *See* abstract of paper by the author, *Lancet* and *British Medical Journal*, 1876; and also "Surgical Diseases of the Kidney," 1885, p. 330 *et seq.*

III. Pyo-nephrosis.

By pyo-nephrosis is understood dilatation of the pelvis and calyces of the kidney with pus, or pus and urine. It is a result of mechanical obstruction with suppuration superadded. (1) The dilatation may have preceded the suppuration for a longer or shorter period, in which case pyelitis will have been superadded to hydro-nephrosis; or (2) the dilatation and suppuration of the renal calyces and pelvis may have commenced and proceeded together. When the two processes begin and advance simultaneously, the pyo-nephrosis is always the result of some lesion, attended with suppuration in the lower urinary organs. When the pyo-nephrosis is due to suppuration supervening upon a previously existing hydro-nephrosis, the septic infection may have ascended from the lower urinary organs to the kidney; or may have been conveyed to the kidney through the blood or the lymphatics. In the latter event the suppurative changes which have commenced in the hydro-nephrotic organ may or may not descend to the lower urinary organs. (3) In a third group the suppuration may have preceded the dilatation, the distension of the renal pelvis and calyces following from the obstruction caused either by masses of pus or muco-pus, or blood - clot or calculus. Sometimes the amount of pus is so small, the pyelitis so slight, and the amount of pent-up urine so large, that the tumour is more a hydro-nephrosis than a pyo-nephrosis, and the condition is then by the French writers named *uro-pyo-nephrosis*. But in all cases where there is suppuration as well as dilatation of the pelvis and calyces of the kidney, the condition is, strictly speaking, pyo-nephrosis.

In advanced cases, the dilatation and suppuration go on to the compression, atrophy, and breaking down of the medullary and cortical substances of the kidney, until at length the whole organ is converted into a large and loculated sac. This sac contains pus, or purulent urine, or urine mixed with muco-pus in larger or smaller quantity; or pus and urine mixed with blood; or a white phosphatic deposit may line the renal pelvis and the loculi into which the calyces are distended; or these spaces may be filled with compact inspissated putty-like pus, and with *débris* of renal calculi—according to the cause of the obstruction.

Etiology.—The conditions necessary for the production of pyo-nephrosis being an obstruction to the outflow of urine

and the penetration of pyogenic micro-organisms to the affected part, these two conditions may, as has been just stated, take place together or either of them may precede the other. Suppuration may be induced through the elimination of micro-organisms by the kidney from the blood, and herein may be the starting of the subsequent cause of obstruction; but in the majority of cases, whether the septic infection is derived from the lower genito-urinary tract or not, there exists, prior to the commencement of suppuration, a state of dilatation of the kidney and often of the ureter also. When the septic infection is ascending and is secondary to dilatation, cystitis and ureteritis precede the pyelitis. When the septic infection and dilatation affect the kidney simultaneously, the kidney having previously been almost, if not quite healthy, it is to the ascending ureteritis (with perhaps peri-ureteritis) and the consequent changes in the ureter that the obstruction to the outflow of urine is due.

As hydro-nephrosis becomes pyo-nephrosis as soon as sup-puration occurs, the causes which produce hydro-nephrosis are the primary causes of pyo-nephrosis also. But when an ob-struction causes pyo-nephrosis at once, it is more complete in its character, and more rapid in its irritative effects upon the kidney, than when it causes hydro-nephrosis first. When pyo-nephrosis is the primary effect, both kidneys are very frequently affected at the same time; but if only one kidney is involved, it in all prob-ability has not had time, as in hydro-nephrosis, to go on gradually dilating and gradually atrophying whilst the other kidney *pari passu* is undergoing compensatory hypertrophy.

When pyelitis or pyelo-ureteritis has preceded the obstruction, the cause of the obstruction is either a product of the inflammation of the kidney, or is the same as that which excited the pyelitis. As a result of pyelitis, the ureter may be blocked by a clot of blood, or a little mass of inspissated pus or muco-pus, or a fragment of cancerous or tuberculous material or of some semi-organised false membrane, or by some white pultaceous matter containing more or less gravel, from the pyo-nephrotic cavity. A vesical calculus or growth, or a cancer of one of the pelvic organs, may be the cause both of the suppuration and the obstruction; exciting, first of all cystitis, and then pyelitis, by extension upwards along the ureter of the inflammatory process; and afterwards giving rise to obstruc-tion by involving and occluding the lower ends of the ureters.

To enumerate all the various causes of pyo-nephrosis would be to give a complete list not only of the causes of hydro-nephrosis, but of those of acute and chronic pyelitis also. The most frequent is calculous pyelitis; indeed, renal calculus is so largely in excess of the other causes of pyo-nephrosis that it has been implied, if not explicitly stated, by some writers, that pyo-nephrosis and calculous pyelitis, when they assume the dimensions of

Fig. 63.—Pyo-nephrosis (forming a Tumour) due to an oxalate of lime Calculus.
(Guy's Hospital Museum.)

a renal tumour (Fig. 63) are one and the same thing. This, however, is not the case, and moreover the relation between renal calculi and pyo-nephrosis is a double one; on the one hand the calculus may be and frequently is the cause of the pyo-nephrosis, but, on the other hand, it may be secondary and arise from the phosphatic deposits of the alkaline urine in the renal cavity. It must also be borne in mind that very marked, and indeed fatal, pyo-nephrosis may exist, whether the result of renal calculus or of other causes, without giving rise to any

palpable tumour during life, as the subjoined particulars prove (*see* Fig. 64).

During the ten years ending 1883 the post-mortem records of the Middlesex Hospital contain thirty-six cases of pyo-nephrosis,
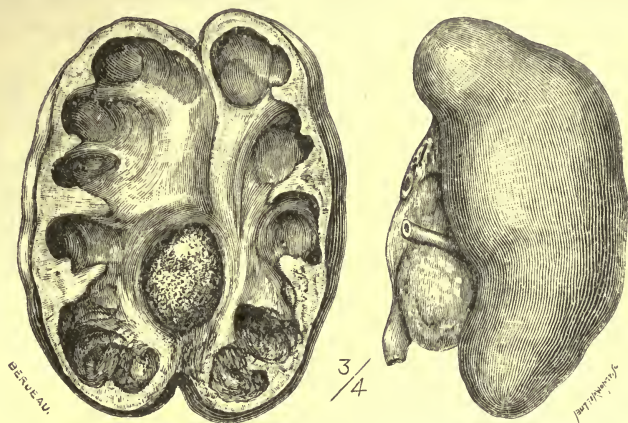

Fig. 64.— Calculous Pyo-nephrosis; great destruction of Kidney substance.   The kidney is below the normal size.   (Guy's Hospital Museum.)

unaccompanied by suppurative nephritis, from causes other than stones in the kidney.

Cancer of uterus and vagina	13
Stricture of urethra	4
Cyst of ovary	2
Uterine fibroid	1
Epithelioma of penis	1
Abscess in bladder walls and cystitis . . .	1
Stone in bladder	1
Villous disease of bladder	2
Sarcoma of bladder	1
Cause of obstruction not stated	10

Of the ten cases in which the cause of the dilatation is not stated there was injury or disease of brain or spinal cord in seven, heart disease in one, Bright's disease in one, and cancer of the breast in one.

In the majority of these cases the pelvis of the kidney is stated to have been " much distended," or " distended and full of purulent urine," or the kidney was found " reduced to a membranous sac, dilated and divided into compartments," etc.   In only one of them, however, was there a renal tumour of any great size.

This was in a man, aged thirty-nine. and its cause was stricture of the urethra. The right kidney was enormously dilated, and formed a tumour which extended from the liver to the pelvis; its secreting substance had almost disappeared; its capsule was adherent to the surrounding parts; and its interior was loculated, and lined by a slaty grey-coloured membrane. The left kidney was in a similar but less advanced state.

A further analysis of cases from the records of the Middlesex Hospital between the years 1884 and 1897 gives seventeen cases of uncomplicated pyo-nephrosis in 3,926 cases. These records show that pyo-nephrosis is sometimes associated with suppurative nephritis, and between instances of pyelo-nephritis with very slight dilatation of the renal pelvis and large-pouched pyo-nephrotic cysts there is every intermediate degree.

In twelve other cases taken from the Middlesex Hospital records during the same period, pyo-nephrosis was complicated with well-marked suppurative nephritis.

The causes of the disease in these cases were :—

Cancer of the uterus and vagina	2
Epithelioma of bladder	1
Stricture of urethra, with cystitis	5
Vesical calculus, with cystitis	1
Enlarged prostate, with cystitis	1
Tubercular disease of bladder and kidneys . .	1
Cause unstated	1

In nine out of the twelve cases the disease affected both kidneys.

Of sixteen cases of renal calculi observed during the same period there was pyo-nephrosis in eleven. In three of the eleven the kidney was extremely sacculated. In a fourth it was converted into a membranous sac, the lower half of the organ being wholly membranous, whilst the upper half retained only a slight trace of renal tissue. In a fifth, the left kidney had lost all its glandular substance, was enormously distended, loculated, and filled with pus and many uric acid calculi, and formed a tumour $6\frac{1}{4}$ inches long and 9 inches in circumference; the right kidney was enlarged, but healthy; the bladder was inflamed, and phosphatic deposits studded its lining membrane. The patient was a man, aged sixty, who died of the pyo-nephrosis and pelvic cellulitis.

Dickinson tabulates ten cases of pyo-nephrosis; in six of

them there was calculus in the affected kidney, and in two stricture of the ureter.

Pyo-nephrosis occasionally occurs in a *movable kidney*, and from some of the more recent foreign writings it would appear as if this were not an unfrequent consequence of the mobility. From my own experience I think the mobility is often a consequence of the weight of the organ, and not the cause of the renal distension and suppuration. Pyo-nephrosis is more often met with on the right side when associated with movable kidney.

Pregnancy leads to pyo-nephrosis as well as to simple renal distension, *i.e.* hydro-nephrosis. I have elsewhere referred to suppurative pyelo-nephritis as a result of pregnancy and parturition. Pyo-nephrosis when caused by pregnancy is almost invariably on the right side, the gravid uterus being inclined to the right, and the fœtal head, owing to the occipito-frontal obliquity, pressing most on the right ureter and compressing it against the brim of the pelvis.

Strumous diseases of the kidney occasionally lead to blocking of the ureter and dilatation of the pelvis of the kidney; but these cases are characterised rather by the caseating deposits in the substance of the kidney than by atrophy of the glandular substance and distension of the calyces.

Partial pyo-nephrosis, like partial hydro-nephrosis, occurs if the obstacle affects only one portion of the renal pelvis, or the opening of only one or two calyces into the infundibulum.

Ewart records a case of sacculation of the lower half of each kidney: each kidney possessed two ureters. The cause of the obstruction was found to be tuberculous disease of the two lower ureters.

The cause of pyo-nephrosis is not always ascertained; it was not discovered in the case of pyo-nephrosis affecting one half of a horse-shoe kidney (Fig. 19, p. 74 *ante*), the specimen of which is in the Middlesex Hospital Museum.

Erichsen mentions gonorrhœa as an occasional cause of pyo-nephrosis, and alludes to a case in which an abdominal tumour was thus formed. Rayer speaks of gonorrhœa as being a not uncommon cause of pyelitis. There is no proof, however, that these were other than instances of post-gonorrhœal invasion of the kidney by ordinary pyogenic organisms, but Dr. Arpad Gerster has recently reported a case in which the gonococcus and the staphylococcus albus were found in the kidney pus, and

Dr. Bransford Lewis * has published a case in which no organisms were present except the gonococci, which had reached the renal pelvis and tubules along the mucous membrane of the bladder and ureter.

Pyelitis followed by pyo-nephrosis sometimes results from wounds and contusions in the renal region. A case of an enormous pyo-nephrotic cyst from injury to the loin occurred in a boy, aged sixteen, who was admitted into the Middlesex Hospital under Murchison.† The tumour first showed itself about eight months after the injury, and went on slowly increasing for seven years.

Morbid Anatomy.—The outline and volume of pyo-nephrosis vary considerably, as do those of hydro-nephrosis.

The tumour may be reniform in outline, and more or less, or not at all, enlarged ; or it may be globular or elongated. Sometimes the enlargement of the kidney is accompanied by an incurving of its two extremities, which tend to embrace the dilated renal pelvis, and thus the kidney acquires somewhat the shape of a horse-shoe.

The renal surface may be lobulated, the lobules forming large rounded cysts, and the pelvis of the kidney is often enormously expanded. In colour it may be in large part the same as the kidney, or it may be greyish-yellow from the proximity of the purulent contents to the renal surface. By gradual absorption or actual destruction, first the pyramids and then the cortex may disappear, until at length the whole organ is reduced to a mere many-chambered sac (Figs. 65 and 66).

The cortex differs very much in character, being in places tough, thick, and resisting, and in other specimens, or in other parts of the same specimen, being so thin as to allow pus to be seen through it, and to admit of an elastic or even a fluctuating sensation being communicated to the finger.

Perinephritis has in most cases been excited, and has led to considerable change in the surrounding cellular tissue, which is often densely adherent to the renal capsule. In some instances the perinephric tissue has undergone considerable fibro-lipomatous increase, and this sclerosed fatty tissue may project far into the renal hilum and between the calyces (Fig. 66).

* *Journ. of Cutaneous and Genito-urinary Diseases,* September, 1900.
† *See* Murchison's " Lectures on Diseases of the Liver, p. 115.

In other instances, suppurative perinephritis is present, and in others, again, the kidney may be encased or "set," as it were, in a dense, tough, and enormously thick mass of fibro-fatty substance, which it is impossible to remove except by detaching the proper capsule of the kidney with it (*see* Fig. 34, p. 272 *ante*).

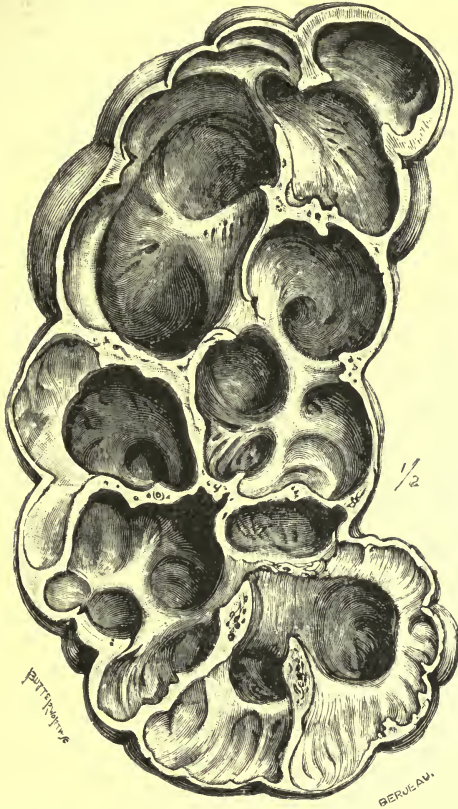Albarran refers to a rare form of subcapsular abscess as

Fig. 65.—Section of a left Kidney in a very advanced stage of calculous Pyonephrosis, and showing numerous cavities.   Symptoms of renal trouble for 24 years.   Nephrectomy.   Author's case.   (Middlesex Hospital Museum.)

occurring in exceptional cases of pyo-nephrosis.   The pus in these cases may form an extensive collection between the kidney and the proper renal capsule, without having any communication with the pyo-nephrotic cavity or cavities.   Albarran gives references to three cases of this sort which were brought before the Société de Chirurgie in 1889 and 1890.

On section the tumour is found to consist of a number of more or

less separate loculi or cysts, which communicate with the renal pelvis and, by means of the pelvis, with one another. These loculi, cysts, or pouches, which represent the dilated renal calyces, vary greatly in numbers and dimensions in different cases.

The cortical and medullary portions of the parenchyma are often indistinguishable from each other, having undergone a con-
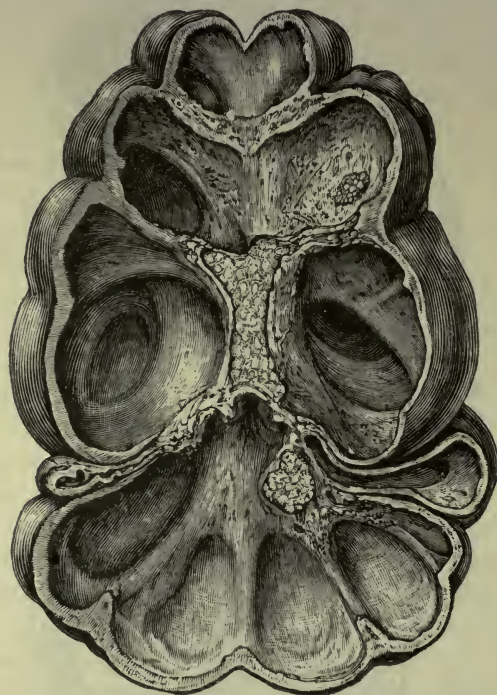

Fig. 66.—Pyo-nephrosis, with fibro-fatty deposit in the Hilum. Removed during life. Author's case.

siderable amount of sclerosis as well as atrophy. Indeed, in some instances, their consistence is almost cartilaginous, and may be even calcareous or osseous. In many cases the parenchyma has suffered changes common in suppurative nephritis, and small abscesses are found in the partitions between the enlarged calyces. The partitions between the pouches are formed by the partially atrophied, or often by greatly sclerosed columns of Bertini. These septa may be (1) thick, tough, and inelastic, and may so surround the loculi that their communication with the renal pelvis is reduced to a very narrow opening, or is closed

altogether, thus converting the loculi into distinctly isolated cysts or abscess chambers (Fig. 65).

(2) Or the septa may be imperfectly developed, and represented only by radiating, slight ridges or projections on the wall of large sacculi (Fig, 66).

(3) Or they may be actually destroyed in places, so that the adjacent pouches communicate. In advanced cases the septa may have quite disappeared, and one large, smooth-walled sac, with a dense fibrous capsule and no trace of renal substance, is the result (Fig. 68).

The internal surfaces of the cysts are often smooth; but at other times they have a rough woolly appearance; or a false membrane of a grey colour, which may be easily detached, lines them. This membrane not very unfrequently is calcified.

Just as some of the pouches, may be entirely shut off from the renal pelvis as well as from one another, so the whole pyo-nephrotic cyst may be shut off from communication with the bladder; or there may be a slight permanent communication allowing of the constant passage of a small amount of pus, or pus and urine, to the bladder; or the communi-
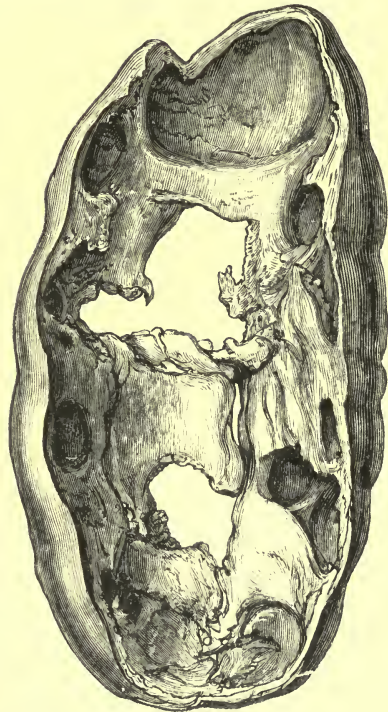
Fig. 67.—Great destruction of the Kidney from calculous Pyo-nephrosis. Symptoms of renal trouble for nine years. Removed during life. (Author's case.)

cation may be an intermittent one, allowing of the occasional emptying of the sac, and thus an intermittent discharge of a large quantity of pus; or again, a pyo-nephrosis which has for a time been quite closed may subsequently become patent by the shifting of a calculus or the giving way of a partition.

As is so often seen after nephrotomy, most of the pyo-nephrotic kidneys, whether packed with condensed pus, or distended with fluid pus, or pus and urine, are able to secrete . urine

after being opened and evacuated. And it is important in this connection to bear in mind that the microscopic lesions of the renal parenchyma are of more consequence than the dimensions of the pouches or the thickness of their walls. Pyo-nephrosis, with thick partitions and a thick rind of parenchyma, may not be able to secrete so much urine, or urine of so good a quality, as those with a much smaller amount of rind and much thinner partitions.

The causes of renal retention, whether calculous or otherwise; and whether situated in the kidney itself, or in the ureter in the form of stricture, curves, twists, or abnormal states, or at the renal or vesical orifice of the ureter, do not influence the characters of the suppurative changes.

The changes in the ureters vary considerably according to the mode of onset of the disease. In cases where the pyo-nephrosis has been preceded by hydro-nephrosis both ureters are frequently affected; they look twisted and tortuous like varicose veins; they are dilated unequally, so that they present a moniliform appearance, especially marked as a rule at the two extremities of the duct and most pronounced at the upper end; they are also increased in length and thus present enlargements, constrictions, and folds. The ureteral walls are in places thin, and are surrounded by loose cellular tissue. The mucous membrane is much inflamed, and glandular cysts are sometimes developed upon it, and there is an increase of the muscular fibres at the situation of the valvular folds which project into the lumen of the tube.

In other cases, where hydro-nephrosis has not been a prominent antecedent, one ureter alone is often affected, there is no elongation of the tube, and the peri-ureteral tissue is tough and adherent: sclerosis and rigidity of the ureteral walls are the principal characters, the dilatation being irregular and comparatively slight. The points of stricture are due to thickening of the wall, not to folds and twists of the ureter. These different changes in the ureter are more fully described in the chapter on Ureteritis and Peri-ureteritis, to which the reader is referred for further details (Vol. II., p. 391 *et seq.*).

The relation and connection of the cyst with the structures surrounding it vary.—Sometimes it forms adhesions on all sides, with the liver or spleen above, with the small intestines on the inner side, with the ascending or descending colon in front or on the

inner side, and with the deep structures of the abdominal parietes behind and on the outer side. The surrounding parts are displaced in proportion to the size of the tumour; if this is considerable, the cyst may push up the liver or spleen several inches and extend a very long way upwards beneath the ribs (adding often considerably to the difficulties and dangers of nephrectomy), as well as displace the intestines inwards, and the parietes at the loin outwards and backwards. Ulceration of the cyst wall, or suppurating tracks formed through what remains of the renal substance, sometimes end in fistulous openings into the parts around; it may be into the cellular tissue of the loin, or into the stomach, duodenum, colon, or peritoneum. Sometimes only one, sometimes several fistulous openings occur in the same case (*see* p. 376 *ante*). As soon as a fistula forms, the purulent urine escapes and gives rise to perinephritis, peritonitis, or the discharge of pus and urine by the mouth or rectum, or through the loin. A fistula may form, as a consequence of pyelitis, before the calyces and pelvis have become much dilated, or the kidney otherwise enlarged; but, except in tuberculous kidney, atrophy of the renal substance, and more or less complete retention of pus or purulent urine in the cavity of the kidney, generally precede renal fistulæ.

In pyo-nephrosis of the left side, the cyst wall may form adhesions directly with the diaphragm; and if the diaphragm becomes adherent to the base of the left lung a fistula may open directly through the muscle into the lung. Urine and pus from the left kidney in this manner come to be expectorated.

The fluid contained in the distended kidney varies in different cases, and even in different pouches of the same specimen. Sometimes it is pus mixed with urine or blood, or pus so concentrated that there is scarcely a trace of urine. The pus may be of a greenish colour or largely mixed with gritty lime salts. If the fluid has become changed by decomposition and the development of ammonia, it is more or less thready and glairy, containing little masses of gangrenous *débris;* and phosphates are often deposited on the walls of the cysts and renal pelvis. At other times the contents consist of a soft mortary material, of a white or yellowish-white colour, and of the consistence of butter.

Calculi, either primary or secondary, are found in many cases in pyo-nephrosis. Primary calculi are often the sole cause of the pyo-nephrosis. Secondary calculi may be situated in any part of the

tumour, either fixed or loose in the pelvis or calyces, or fixed
in the cortex near the surface. Often these calculi are covered with
a thick layer of cheesy pus, or muco-pus, which may be of a
brownish colour from the presence of blood. They have in some
instances a most fœtid, feculent odour. I have known calculi
to stink most horribly for many days after extraction by
nephrotomy and exposure to the air.

In other cases the fluid may be simply urine which contains

Fig. 68.—Kidney of which the Pelvis is
blocked by a Calculus.

The chambered and enlarged cavity of the kidney
was filled with thick greenish pus and
calculous material. (From specimen in St.
George's Hospital Museum.)

Fig. 69.—The same Kidney as shown in
Fig. 68.

It has been converted into a chambered cyst six
or seven times larger than the normal kidney,
with thick fibroid walls and septa. Lithatic
calculi are contained in the chambers and
embedded in the septa. The cavities in the
recent state, as well as part of the ureter,
were filled with pus. From a man, aged 43,
who died of œdema glottidis.

very little, if any, urea; or it may be urine mixed with a very
small quantity of pus, and it is this variety which has been
termed uro-pyo-nephrosis. The micro-organisms which are most
commonly found are bacillus coli, staphylococci and streptococci,
and proteus. Melchior has shown that the bacillus coli is much
the most frequent of all forms of urinary infection. In a large
number of samples examined, this bacillus alone has been found,
but it is often present with other micro-organisms.

When a calculus is formed in the kidney it often assumes
a branched shape which exactly fits the pelvis and calyces ; in
other instances, one calculus blocks the ureter, and more or less

fills the pelvis, whilst other independent calculi occupy one, two, three, or more of the calyces (*see* Figs. 68 and 69).

It does not always happen that a calculus which is large and branched, occupying pelvis and calyces too, obstructs the urine altogether. In such cases the kidney does not become enlarged, though the mucous membrane of the pelvis and calyces is much inflamed. On the other hand, when a small stone is impacted in the ureter the kidney is likely to suffer quite as seriously, to become the subject of a general pyelitis and to be rapidly distended with urine mixed with mucus, pus, and blood. Le Dentu in two cases observed the presence of gas, and Tuffier, like myself, has found pyo-nephrosis complicating a polycystic condition of the kidney. In such cases pus is found in many of the cysts. In some cases, although the kidney becomes completely sacculated and loculated, and left without a trace of glandular tissue, the organ, instead of being enlarged, is actually reduced in size below normal, owing to shrinking of the cyst.

Microscopically, the renal tissue is found to contain an excess of connective tissue and often presents appearances like those of diffuse suppuration of the kidney. The septa between the pouches are fibrous, and the walls of the arterioles running in them are much thickened and their lumen diminished, and may be actually obliterated. In old pyo-nephrosis even the vessels of the pedicle may be obliterated; they are very commonly diminished in calibre and have thickened, rigid walls. In rare cases all trace of renal tissue has disappeared; but, on the other hand, there are often present patches of true hypertrophy, or, at least, parts in which the renal tubules and glomeruli, well preserved, are lined with normal epithelium and secrete urine freely.

Symptoms.—In the early stages of the development of pyo-nephrosis the symptoms will be those excited by the cause of the obstruction, whatever that may be, whether calculus, or stricture of the urethra, or enlarged prostate, etc.; afterwards there will be added those of renal distension and pyelitis. In pyo-nephrosis due to some cause in the lower urinary organs, cystitis very frequently precedes it, and in the cases in which the cause of the pyo-nephrosis is in the kidney itself, reflex vesical symptoms such as frequent and painful micturition are very common and are too often attributed to cystitis. When the pyo-nephrosis is the result of an obstruction following pyelitis or pyelo-nephritis, the symptoms of this disease

will be followed by other and often well-marked symptoms, such as fever accompanied by the development of a tumour, by pain caused by renal distension, and possibly by the occasional evacuation of large quantities of pus followed quickly by the subsidence of the tumour. In intermittent evacuations of the contents of the kidney, whether complete or partial, it is during the complete retention that the characters of the urine improve, whilst the general symptoms of the patient become worse. If the obstruction is not complete there will be pus in the urine; if complete but intermittent, there will be intervals when no pus is discharged; whilst if the obstruction is both complete and permanent there will be an entire absence of pus in the urine.

General symptoms.—There will be constitutional symptoms of suppuration; sometimes shivering, sometimes a high temperature at night without rigors; emaciation, great prostration of strength, loss of appetite, perhaps sickness and diarrhœa, and often a dusky pallor or sallow tinge of skin. When the pyelitis is very chronic and severe there may be all the symptoms of hectic fever. When pyo-nephrosis occurs as the result of pregnancy, it is usually during the period from the fourth to the sixth month that symptoms set in; these consist of frequent and painful micturition, severe pain in one or the other loin, purulent urine, high temperature, perhaps rigors and generally considerable gastric and nervous disturbances, such as sickness, vomiting and restless excitement. The same symptoms are, however, caused by pyelo-nephritis without pyo-nephrosis; so that in the absence of proof that hydro-nephrosis had previously existed, and had become infected, the diagnosis of suppurative diffuse nephritis is even more probable than that of pyo-nephrosis during pregnancy.

Tumour.—The presence of a tumour together with fever and the other general symptoms mentioned is characteristic of pyo-nephrosis; but various conditions may prevent the detection of a tumour such as the configuration and obesity of the patient, the subcostal position of the enlargement, or, chief reason of all, because of the absence of any marked enlargement of the kidney. On the other hand, in thin persons and where the increase takes place below the ribs, medium sized or even small tumours may be easily detected. Variations often occur in the volume of the tumour, and I have seen and collected a number of cases in which

the tumour has subsided once or oftener and finally never again reappeared.

When a pyo-nephrotic swelling presents itself in one or the other loin it possesses the same characters as a hydro-nephrotic tumour. It is elastic or fluctuating, or nodulated and hard, and bulging backwards into the flank as well as occupying more or less of the abdomen. If the tumour is not large, there will be no actual prominence or bulging of the loin, but merely a slight fulness, or it may be even only just the loss of the natural incurvation of the region. As the kidney becomes more distended and enlarged, the flank may become more and more prominent, until at length a tumour can be both seen and felt projecting the abdominal walls of the ilio-costal space outwards and backwards. In many cases the tendency is for the tumour to increase towards the thorax, pushing upwards the liver or spleen and reaching to a height beneath the ribs which has sometimes quite astonished me. In some cases a pyo-nephrotic kidney may so expand in this direction, and in this direction only, that scarcely any, if any, enlargement is detected by palpating the loin or the abdomen. In other cases, when it is of very large size, the tumour may reach the iliac fossa, or even Poupart's ligament or the hypogastrium, and may weigh from ten to thirty pounds or more. On percussion there is as a rule dulness in the flank and not unfrequently the want of resonance extends for some distance forwards ; but the extent of anterior dulness varies, because if the colon is distended with flatus there may be resonance for some distance outwards as well as over the front and inner side of the tumour.

Unless pyo-nephrosis occurs in a movable or horse-shoe kidney, as is sometimes the case, there is always dulness posteriorly. When the tumour is not of great size there may be a line of resonance in front, above it, on the left side between it and the spleen, and on the right side between it and the liver ; but if it be of considerable dimensions it may have formed adhesions with the under surface of the liver or spleen, and so simulate a tumour or hypertrophy of one or other of those organs. If very large the tumour has almost always a more or less bossy or lobulated outline ; when this is the case and fluctuation is also distinct, hydro- or pyo-nephrosis is clearly indicated.

When the cause of the obstruction is intermittent in its action,

the lumbar tumour will diminish, or may even disappear altogether after the discharge of a large quantity of pus.

Pain.—Pain is by no means a constant or a pronounced symptom. It is often absent altogether throughout a long part or the whole of the course of a case. It is due when present to intra-renal tension, or to dragging, or pressure upon surrounding parts. The pain may be nothing more than a dull aching with or without exacerbations of acute suffering, radiating along the course of the ureter to the penis, and down the thighs. There are in some cases paroxysms of great severity. As in perinephric abscess and other renal enlargements, the patient may bend to the affected side or keep the thigh bent upon the abdomen in order to relieve the suffering caused by making tense the psoas muscle.

The pain experienced depends greatly on the size of the tumour, pressure over the front of which nearly always aggravates or provokes pain if it was not present before. Pressure over the flank, in some cases, is not only well borne but actually gives relief. If the abdomen is carefully palpated there may be tenderness along the course of the ureter, and a rectal or vaginal examination often causes pain and reveals marked thickening of the ureteral walls.

Urine.—The urine should be carefully and frequently examined. Pus, and occasionally a little blood, are the abnormal substances it contains. If the ureter is completely blocked, the total quantity of urine excreted for a time, at least, after the occlusion will be markedly diminished. The compensatory function of the other kidney may, however, soon bring the amount excreted up to normal. If partially blocked, the quantity of pus and urine will vary from time to time, even during the same day. If the cause of the obstruction shifts so that the ureter, from being quite blocked at one period, becomes patent at another, large quantities of purulent urine will be passed during the patency periods only, the urine in the intervals of occlusion being quite clear and natural provided the opposite kidney is healthy. In the case of pyo-nephrosis in one half of a horse-shoe kidney, from which Fig. 19 (p. 74 *ante*) was taken, the patient, seven years before his death, complained of severe abdominal pain and constipation. Fourteen days after the onset of these symptoms there was a rise in his temperature, and two days later, when at stool, he

felt something give way in his belly. On the day but one after this sensation a large quantity of pus was passed in his urine (one-fourth to one-third); pus continued for a few weeks, and then ceased.. He began to feel quite well as soon as the pus began to pass. The patient died, aged fifty-five, of syphilitic disease of the brain; but though his urine during the seven years' interval was several times examined, it was not purulent. At the post-mortem examination, the left part of the kidney was distended with pus.

It is well to watch the urine continuously and carefully, the total quantity · passed during twenty-four hours being collected and measured. In suppurative pyelitis there may be more or less dysuria, but though the urine contains pus and may be glairy and alkaline as it comes from the affected kidney, yet that which is voided may not contain any marked quantity of mucus, and will probably give an acid reaction.

In pyelitis, associated with renal obstruction (i.e. in pyo-nephrosis), the urine decomposes in the calyces, becomes alkaline and then glairy, like the urine in cystitis, but when passed, being mixed with that from the opposite kidney, it is less markedly glairy and less alkaline than in cystitis. Indeed, it may not be at all alkaline, but neutral or even acid if the opposite kidney is healthy.

In cases of pyo-nephrosis with ascending uretero-pyelitis it is more than probable that the characters of the urine excreted will be changed by co-existing cystitis or suppurating pyelo-nephritis of the opposite kidney.

The quantity of pus passed from a pyo-nephrotic kidney, as previously stated, varies much in quantity according to the degree of patency of the passage, and the intensity of the suppurating process; but it forms usually a considerable deposit at the bottom of the urine glass, and after standing many hours the supernatant urine is still rendered opaque or turbid by the pus suspended in it.

Diagnosis.—It is very necessary in pyo-nephrosis, as in hydro-nephrosis, to correctly diagnose the nature of the tumour, because the operative treatment, which is so beneficial in them, might be disastrous in tumours of a different nature.

The tumours which may be mistaken for pyo-nephrosis are thus enumerated by Rayer: "On the left side of the abdomen,

all those which result from morbid enlargement of the spleen ; on the right side the tumours of the liver and gall-bladder ; on either side the various renal tumours of another nature, such as hydro-nephrosis, hæmorrhage into the cavity of the pelvis, cancer of the kidney, tubercle, kidneys containing hydatid cysts ; extrarenal abscess, either idiopathic or consecutive to perforation of the kidney or of the colon or cæcum ; abscess arising from caries of the spinal column ; tumours of the suprarenal capsules ; aneurysms of the aorta ; encysted tumours of different contents, hydatid or otherwise ; and lastly, fæcal tumours from the accumulations of fæcal matter in the colon or cæcum."

For the distinguishing characters of these I must refer the reader to the chapters on renal tumours (p. 529), hydro-nephrosis (p. 398 *et seq.*), and perinephric abscess (p. 270 *et seq.*)

It must suffice here to state that pyo-nephrosis is usually preceded and accompanied by febrile symptoms ; that the tumour is more or less tender and the pain is increased by pressure over it, and by movements of the trunk ; and that when the ureter is not absolutely occluded there is the presence in the urine of more or less pus.

When pyo-nephrosis affects a horse-shoe kidney there may be no tumour, and the diagnosis may be impossible. It was so in the case from which Fig. 19 (p. 74 *ante*) was taken.

In *hydro-nephrosis* there is an absence of febrile symptoms and of pus in the urine. In perinephric abscess there is more pain than in pyo-nephrosis, the course of the fever is more severe and rapid, and fluctuation succeeds to ill-defined hardness about the loin and iliac region, and not to a gradually developing circumscribed tumour. In perinephric abscess there is extreme tenderness before there is any sign of fluctuation or elasticity, the thigh is often flexed upon the abdomen, and cannot be extended without great pain ; and there is generally redness and œdema of the skin of the loin ; there is no pus in the urine ; and when pus has formed in the circumrenal tissue, fluctuation is more easily made out, and is more superficial than in pyo-nephrosis.

It is from hydro-nephrosis and *perinephric abscess* that the diagnosis of pyo-nephrosis is most difficult, and fortunately it is of less consequence if a mistake is made between them than in most other cases, because a lumbar incision with a

view to nephrotomy would give vent to the pus of a perinephric abscess, and nephrotomy is equally advantageous for hydronephrosis as for pyo-nephrosis. In opening a perinephric abscess, if the discharge has any of the characters of urine it. will be safe to infer that the abscess communicates with the kidney. Sometimes the sequence of the clinical symptoms will have indicated that pyelitis or pyo-nephrosis preceded the acute symptoms which culminated in perinephric abscess. In other cases a digital examination of the wound will disclose the diseased condition of the kidney, and perhaps detect a perforation in its capsule. Under these circumstances the surgeon would open the kidney, as in simple hydro-pyo-nephrosis. or pyo-nephrosis.

If, on the other hand, no symptoms which suggest disease of the kidney itself, such as nephritic colic, or the passage of blood or pus with the urine, have preceded or accompanied the formation of the swelling in the lumbar region ; and if the kidney, with the finger in the wound, is felt to be of normal size and character, there will be no reason to suppose that the case is other than an abscess in the perinephric tissue uncomplicated at least by renal disease.

It must, of course, be understood that the diagnosis should be pushed not only to the making out of the nature of the tumour, but also of the character of the obstruction which has led to the renal distension. To this end the urethra, prostate, and bladder must be carefully interrogated ; and the various parts of the abdomen and pelvis must be examined by palpation and percussion so as to detect or exclude the several extrinsic causes of occlusion of or pressure upon the ureter. It will seldom be necessary to perform nephrotomy for an accumulation of urine or pus in the pelvis and calyces of the kidney if the distension has been caused by cancer of the penis, stricture of the urethra, enlargement of the prostate, paralysis of the bladder, a stone impacted in the vesical orifice of the ureter, or by an ovarian cyst or a uterine myoma or other form of tumour which was itself removable.

Pyelo-nephritis without retention of urine may sometimes be mistaken for a pyo-nephrosis, especially if the kidney is much increased in volume and a large amount of pus is in the urine. The diagnosis may sometimes be made easy by the presence of sudden large discharges of pus in the urine,

which, as we have seen, occur in cases of pyo-nephrosis, but do not do so in suppurative pyelo-nephritis. The quantity of pus in the urine apart from the sudden discharges is generally much larger in pyo-nephrosis than in pyelo-nephritis, and there is a greater admixture of mucus; the urine, too, may be neutral or slightly alkaline, at any rate during the time of the great purulent out-flows.

The diagnosis of pyo-nephrosis of *tuberculous* origin may often be determined by the presence of caseous masses and tubercle bacilli in the urine, and in doubtful cases the detection of tuber-culosis of other organs will further strengthen the diagnosis.

A *suppurating cyst or abscess* opening into the bladder will sometimes give rise to a purulent discharge resembling pyo-nephrosis, but a careful pelvic examination, aided by an inspection of the abnormal opening into the bladder through the cystoscope, will generally make the nature of the case clear.

In the rare cases where a collection of pus opens into the ureter at any point in its course the diagnosis from pyo-nephrosis may be impossible.

Ureteral catheterisation is occasionally a useful adjunct in ascertaining (1) on which side the pyo-nephrosis is situated, and (2) the condition of the urine coming from the opposite kidney. The difficulties of the operation, especially in the male, are, however, great so that it must not be by any means regarded as a routine method of diagnosis, though occasionally it may be very useful.

It will be borne in mind that pyo-nephrosis of ascending origin is often associated with cystitis, and with pyelo-nephritis and ureteritis of the opposite side. In pyo-nephrosis from causes independent of affections of the lower urinary organs, the characters of the urine together with a unilateral renal en-largement, if present, and of sudden intermittent discharges of large quantities of urine and pus if such occur, make the diagnosis clear. If there is a previous history of renal calculus, if there are crystals in the urine, and if renal pain and hæmaturia are brought on by movement and appeased by rest, then the diagnosis of calculous pyo-nephrosis is indicated.

If, with the characters of urine previously described, there is a movable or misplaced kidney, with localised pain of an aching kind, or with acute painful crises, and nervous or digestive troubles, the diagnosis will be pyo-nephrosis from movable kidney.

If renal pain and swelling, purulent urine, feverishness, loss of appetite, with or without frequent or painful micturition, occur during pregnancy or after parturition, and if the urine has not the characters of cystitis, either pyelo-nephritis or pyo-nephrosis will be present. The diagnosis between these two conditions is very difficult and depends chiefly upon the degree and rate of development of the renal tumour. The swelling in pyelo-nephritis is more rapid, but does not attain to so great a size as pyo-nephrosis. The two conditions sometimes exist simultaneously.

Prognosis.—To a considerable degree the prognosis depends on what has caused the renal distension, whether cancer of the pelvic organs, stricture of the urethra, enlarged prostate, vesical calculus, or the impaction of a calculus in one ureter with or without disease of the opposite kidney. In all these and such-like cases the prognosis is mainly decided by the nature of the determining cause. When, however, pyo-nephrosis of one side only is produced in a person with previously healthy kidneys by some cause which occludes the ureter and does not interfere with the opposite kidney, the prognosis as regards life at least is good if early relief to the pent-up urine and pus be given; otherwise the tumour may cause death by dyspnœa or other effects of pressure, or by sapræmia or other form of septic infection, or may burst at the surface of the body and give rise to a permanent fistula in the loin or groin; or into the colon or small intestine, the stomach, or through the diaphragm into the pleura or a bronchus, and death will occur sooner or later from exhaustion, diarrhœa, vomiting, blood poisoning, empyema, or suffocation; or, again, it may burst into the peritoneum and cause death rapidly by peritonitis, or slowly after having formed a circumscribed peritoneal abscess.

Dr. E. H. Bennett [*] of Dublin showed a left kidney on the anterior surface of which a small opening allowed pus to escape freely into the peritoneum from a large abscess due to distension of the pelvis of the organ by a calculus impacted in the left ureter. The bladder showed signs of acute cystitis. The man (a sailor) had, seventeen months before, had an injury to his perinæum (probably ruptured urethra), and numerous small calculi " came away through a stricture of the urethra."

The most favourable result is when the obstruction gives way

* *British Medical Journal*, p. 361 (March 13, 1875).

and does not recur, and the contents of the tumour discharge themselves along the ureter. Even in this case the affected kidney may be permanently damaged and continue for the rest of the patient's life to discharge pus as well as secrete urine. In such circumstances death from lardaceous or septic disease may take place unless the suppurating cavity is removed by nephrectomy.

In cases in which the opposite ureter is already blocked or the opposite kidney is destroyed, complete anuria and death take place. Temporary anuria has been known to occur when one kidney only was obstructed.

If suppression of urine is prolonged beyond three or four days a fatal issue must be looked for ; though there are numbers of cases in which not a drop of urine has been secreted for nine days and more, and yet recovery has followed.

Treatment. — Suppuration of the kidney or the renal pelvis, especially when associated with obstruction, is always a serious condition, and too much stress cannot be laid upon the desirability of using every care to prevent its occurrence.

If suppuration has occurred, the lines of treatment to be adopted, as far as possible, are—

1. To remove the cause.
2. To cure cystitis, if existing.
3. To attack the infective organisms.
4. To establish a free outlet for the pus.

The methods by which these principles are to be carried out vary with the cause of the distension and suppuration of the kidney, and whether it is situated within the kidney itself or in some part of the lower urinary passages.

1. Attention must be directed to any morbid condition which may be affecting the lower urinary organs. If the cause is a removable or remediable one, such as stricture of the urethra, prostatic enlargement, vesical calculus, etc., appropriate surgical treatment must be addressed to it. Tumours of the ovary, uterus, or of the bladder, should be removed when possible. If a calculus can be felt in the vesical orifice of the ureter, it should be extracted through the bladder if possible ; and if a calculus be impacted in the ureter, too high to be felt from the bladder and too low to be reached through the kidney, it must be excised by one of the methods described in the chapter on

ureterotomy ; or possibly nephrectomy may have to be performed if the calculus is in the ureter, below the brim of the bony pelvis, and the kidney itself is very much disorganised.

2. If chronic cystitis exists, daily irrigation of the bladder will be necessary, both to obviate decomposition of urine and to restore the mucous membrane to a healthy state. In many cases this has been followed by the most marked improvement in the state of the kidney.

3. Free irrigation of the kidneys must be facilitated by giving mild diuretics and bland fluids, such as milk, distilled water, and other diluents in the form of mineral waters.

Attempts may be made to influence the micro-organisms by mildly antiseptic drugs, such as cystamine, urotropine, salol, boric acid, and biborate of soda ; but these medicines, unfortunately, have but little definite effect upon the kidney. If, however, the urine is alkaline, cystamine or benzoic acid frequently produces, within a short time, an acid reaction of the urine.

Astringents, such as tannin, alum, acetate of lead, are given with a view of controlling the flow of pus, especially in the chronic cases, but with not very encouraging results. The tincture of the perchloride of iron is, however, sometimes useful.

The constipation, flatulence, atony of bladder, and general arterial and muscular feebleness which so commonly exist, suggest remedies which will give tone and contractile force to the muscular fibres of the viscera and blood-vessels.

When fever assumes the remittent form, 5 grs. of quinine in ʒj of lemon juice, and ♏xv of Liq. morph. Hydrochl. are sometimes very efficacious in checking the attacks.

The bowels should be kept well opened, and for this purpose warm abundant enemata, containing from ʒiv to ʒvi of glycerine, are of great and special service.

The diet should be light and moderate, and should consist chiefly of fish, milk, chicken, or game, light farinaceous and milk puddings, and well-cooked vegetables ; uncooked vegetables or fruits and much butcher's meat should be avoided. Stimulants should be taken, if at all, in very small quantities ; and if during their administration the pulse is quickened, the temperature raised, or the urine becomes more purulent, they should at once be discontinued.

In acute cases, accompanied by pain, hæmaturia and frequent

micturition, relief may be obtained by hot fomentations, cupping, or the application of leeches to the loins.

4. When a definite diagnosis of pyo-nephrosis has been made, or when in the absence of a renal tumour this condition is believed to exist, the question of operation has to be considered.

Prior to the formation of a tumour the development of pyo-nephrosis can only be conjectured by the presence of pus in the urine and the associated symptoms due to the obstructing cause. If the obstruction prevents altogether the downflow of the contents of the kidney, there will be nothing but the diminution in the daily quantity of urine to indicate distension of the cavity of the kidney, and the question whether the fluid retained therein is urine or urine and pus can only be answered by the presence or absence of febrile symptoms.

When the cause of the obstruction has not long existed, and is probably due to a small calculus or a plug of mucus, pus, blood, or false membrane in the ureter, it may be displaced if time is allowed and hot liquids, such as weak tea or other simple diluents, are freely imbibed. Palliative treatment of the tumour is permissible (a) when there is not complete obstruction, and the pus and urine can escape by the ureter; (b) when there is neither septic fever, diarrhœa, emaciation, nor pain, and the tumour is not of such a size as to threaten rupture; (c) when the tumour, from having been of large size, has diminished, by the emptying of the cyst along the ureter into the bladder; (d) when the surrounding organs and tissues are not excited to inflammation; and (e) when the advanced age of the patient, or some serious complication of bladder, uterus, or other organ renders any operation a danger in itself. Under these circumstances we shall help to diminish the suppuration, and prevent the occurrence of acute inflammatory action in the cyst, by rest in bed or on the couch, frequent hot baths, anodyne and emollient applications to the loin and abdominal walls, gentle compression by belladonna plasters, the avoidance of constipation or the accumulation of fæcal matter in the colon and cæcum, and by a light digestible diet, properly regulated according to the constitution of the patient.

Nephrotomy.—In most instances, however, the only safe treatment is an operation, palliatives being useless, and delay in operating dangerous. The circumstances which indicate operative treatment

are constant pain, increasing size of the tumour, continued fever and evening elevations of temperature, or serious interference with the functions of the stomach and intestine by reflex irritation or by direct pressure of the tumour. An operation is also requisite when the surrounding structures are inflamed or are becoming adherent to the tumour, or when the tumour threatens to rupture or ulcerate.

The objects of the operation are to evacuate the pus, and to remove if possible the cause of the obstruction. As simple puncture is not efficacious and cannot be recommended, even for the purpose of evacuating the contents of the kidney, nephrotomy is the operation which ought to be performed. In many cases, however, the question of nephrectomy has also to be considered. Lumbar nephrotomy with drainage possesses in the majority of cases very great advantages over all other forms of treatment; it is simple, rapid, attended with but little shock, and any secreting substance which remains is free to resume its functions. Rapid amelioration of the patient's condition, therefore, often follows, for not only is the pent-up pus evacuated, but the remaining kidney tissue, relieved from pressure, becomes more active, and a freer secretion of urine takes place, with general benefit to the patient.

Primary nephrectomy may at first sight appear the sounder procedure, since it deals with the root of the evil, but practical experience proves its results to be inferior to those of nephrotomy; and there is often the unknown condition of the opposite kidney to be considered. Nephrectomy should therefore be reserved for those cases in which the kidney substance is totally destroyed, or in which drainage of the multilocular organ is imperfect; and even then it should only be performed when the general state of the patient is capable of bearing the shock of the operation which is often undeniably great. Each case must be considered on its own merits, and the decision will be made easier if there is any guide to the condition of the opposite organ. Nephrectomy is, for instance, often advisable in advanced tuberculous pyo-nephrosis, for if nephrotomy only is performed, the remainder of the diseased kidney will be of but little use, and there is always the risk of tuberculous infection extending to the ureter or to the perinephric tissues. On the other hand, a simple pyo-nephrosis is nearly always best treated by nephrotomy.

Calculous pyo-nephrosis varies so much in its nature and surrounding circumstances that no absolute rule can be established; but in the great majority of cases nephrotomy is the operation which ought to be performed. Nephrectomy should be reserved for the most extreme cases of renal destruction and distension. I have in some cases contented myself with nephrotomy and the extraction of the calculus when the kidney has been well-nigh converted into a congeries of abscess sacs, filled with pus of the consistence of cream cheese. I have scooped out and washed out these sacs and drained the kidney with the happiest results, the patients recovering without fistula, and though for a long time the urine has continued purulent, the amount of pus has diminished as the patients have become robust.

When the contents of the distended kidney have infiltrated the perinephric cellular tissue, and set up perinephritis or perinephric abscess, there is increased reason for the lumbar incision. The depth at which the pus is situated from the surface, the length of time requisite for the parietal tissues to become thinned by the suppurative process, and the comparative readiness with which the abscess can open into the peritoneum, or at any rate in some direction less favourable than externally, render waiting for pointing or even for fluctuation most injudicious. Nephrotomy in such cases as these gives great and instant relief, and in individuals with fairly good constitutions it may be said to be quite free from danger.

What has been said under the treatment of renal abscess respecting the shutting off of one abscess space from others, and of the necessity of opening each suppurating chamber, should be borne in mind in operating on a case of pyo-nephrosis. After opening the kidney, the interior of the loculated cyst should be examined with the finger and with the probe, in order to break down the septa, and to ascertain the presence or not of a calculus in the pelvis or upper end of the ureter. This procedure ought not to be omitted. If a calculus be found in the kidney it should be removed. The extraction, though sometimes difficult, may be generally effected by forceps, or by the curette and finger; sometimes with a blunt hook the calculus may be drawn into a part of the cyst from which it can be easily extracted, or it may thus be brought quite up to the external wound. If no

stone is found in the kidney there may be one in the ureter ; and indeed in *every case*, whether a calculus is extracted from the kidney or not, the ureter should be tested by passing a bougie along it from the kidney to the bladder.

In any case in which the pyo-nephrotic kidney is unduly movable, it should be fixed by sutures in its proper position, provided that the passage along the ureter is free and has not become permanently more or less obstructed by flexures or curves, which are fixed by peri-ureteritic adhesions.

Nephrectomy.—When after nephrotomy a fistulous opening remains permanent, and a considerable quantity of pus daily escapes through it, especially if the matter discharged is very offensive, or when prolonged suppuration or lardaceous disease threatens, nephrectomy should be performed.

If the cause of obstruction is irremovable, either nephrotomy, which will be necessarily followed by a fistula, at any rate for a time ; or primary nephrectomy, if the condition of the kidney is such that no useful amount of secreting tissue remains, must be performed. I would again point out, as I did with regard to hydro-nephrosis, that after an uncertain interval in a few cases a lumbar fistula which has followed nephrotomy may close, owing to the gradual reopening of a good channel through the ureter: this, however, cannot be relied upon, as we have no data at present to guide us as to the cases in which this may be expected to happen. Should the fistula persist, secondary nephrectomy can be performed if the other kidney shows itself reliable.

In pyo-nephrosis occurring during pregnancy it may be necessary to produce abortion or induce premature labour. In the case of a lady referred to me by Dr. Cullingworth, and whom I saw in consultation with Dr. Wilcox, we were able to tide the patient on to the beginning of the eighth month, when labour had to be induced. Many months after recovering from her confinement, however, nephrectomy had to be performed on account of the supervention of acute suppurative pyelo-nephritis. It is open to question whether it would not have been greatly to the patient's advantage if premature labour had been induced at the outset of the disease ; in this case I think it possible that the kidney might have been saved had that been done.

Ureteral catheterisation and irrigation have been employed in the treatment of pyo-nephrosis in three or four cases by Pawlik and Albarran. It consists in catheterising the ureter of the affected kidney daily or well-nigh daily, the catheter being passed as far upwards as the renal pelvis, and the cavity of the kidney irrigated at the time through the catheter. This treatment, which it would be impossible to employ in many cases, and which it would be very dangerous to attempt in others, is not needful or desirable in any. When the obstruction is in or near the pelvis of the kidney it is unsurgical and unscientific; when in the lower urinary passages it is fraught with the great danger of carrying a worse infection to, or increasing the infection of the ureter and kidney. When the obstruction is in the ureter at or near the vesical orifice the treatment if it can be tolerated by the patient is too tedious in performance, too indirect in its action upon the kidney, and too little permanent in its effect upon strictured tissue to be recommended. Though two cures have been claimed, and two cases are said to have been ameliorated after many weeks of this treatment, the objections to it are overwhelming, and cannot be better described than by one of the surgeons who has employed it, and who extols ureteral catheterisation in certain other cases either as a palliative or a curative measure.

Partial nephrectomy has been successfully employed in some exceptional cases by Kummel, Bardenheur, Tuffier, Wartz and Albarran, either to minimise a very large sac or to remove a portion of the kidney expanded below the level at which the ureter joins the infundibulum; or because the lesion involved only a part of the organ.

Plastic operations.—In some cases of hydro-pyo-nephrosis the various plastic operations for overcoming obstructions to the course of the urine, recommended and successfully practised for hydro-nephrosis, may be performed. But in pronounced pyo-nephrosis these operations are not usually, if at all, applicable as primary surgical methods, owing to the febrile condition and marked debility of the patients. Even as secondary measures they are not indicated when the kidney is converted into a many-chambered abscess cavity with rigid septa; or when the ureter is thickened, tortuous and rigid from long-standing ureteritis and peri-ureteritis.

IV. HÆMATO-NEPHROSIS AND URO-HÆMATO-NEPHROSIS.

Besides hydro-nephrosis and pyo-nephrosis there is another variety of nephrectasis, namely that in which the calyces and pelvis of the kidney are distended with blood, either in the fluid or coagulated form; or with blood largely mixed with urine.

The term " hæmato-nephrosis " should not be applied to those subcapsular hæmorrhages in which the blood is extravasated between the fibrous capsule and the renal parenchyma—instances of which I have related (see pp. 150 and 151, ante) and a good example of which was reported some years ago by Nelsen. Still less should cases of extravasation of blood or blood and urine into the perinephric tissue be described as hæmato-nephrosis and uro-hæmato-nephrosis : such a designation even with the prefix " false " (false hæmato-nephrosis) is entirely a misnomer.

Etiology.—This variety of nephrectasis is rare, but there are several conditions which give rise to it.   Injury, renal calculus, a new growth in the renal pelvis, movable kidney, chronic nephritis with or without small cysts (Poirier's case), continued fevers, purpura (Fig. 70, p. 475), or in fact any condition which provokes renal hæmaturia may give rise to hæmato-nephrosis.

Uro-hæmato-nephrosis when it occurs is generally due to the giving way of some one or more of the congested vessels in the wall of a hydro-nephrotic kidney (Albarran, Andersen, Allingham, Bazy, Loison, and others).   It is more likely to occur when the hydro-nephrosis is intermittent owing to the sudden loss of the hydrostatic pressure when the renal retention ceases and the renal cavity is suddenly emptied.   The escape of blood into the hydro-nephrotic sac under these circumstances resembles the hæmorrhage which takes place occasionally into the urinary bladder after too suddenly emptying that viscus of retained urine; and also the hæmorrhage which sometimes quickly fills the sac of a large old hydrocele after the withdrawal of the fluid.

The hæmato-nephrosis which follows an injury may be one of two varieties. (1) It may be caused by hæmorrhage from small vessels in the wall of a calyx or in the parenchymatous substance bordering a calyx.   In this case the accumulation of blood takes place slowly and the renal substance may by degrees become entirely atrophied.   (2) The blood may come from a

ruptured branch of the renal artery in which case the kidney
is most likely to dilate rapidly. Such cases form one of the
varieties of traumatic renal aneurysm which I have previously
described (p. 239), and examples of which I have quoted in my
paper on " Renal Aneurysm " in the *Lancet* of October 6th, 1900.

The hæmato-nephrosis caused by calculus may attain very
large dimensions. It is, so far as my personal experience goes,
associated almost invariably with calculi of long standing and
great size. The general health and strength of the patient are
very greatly impaired, he becomes of a sallow and malignant
aspect, and the tumour formed is prone to be mistaken for
carcinoma of the kidney, or liver, or spleen.

A small rough calculus may however be both the immediate
and the indirect cause of hæmato-nephrosis; it may lead to
hæmorrhage by bruising or laceration of the renal mucous
membrane, and may be the cause of complete obstruction to
the escape of the blood by falling over and entirely blocking
the upper ureteral orifice.

New growths in the renal pelvis or ureter, whether simple
papilloma, or malignant, are very prone to excite considerable
hæmorrhage, and may, like a calculus, also be the means of
obstructing the passage down to the bladder (cases are recorded
by Tuffier and Pantaloni).

In the case of movable kidney the repeated kinking of the
ureter may have induced hydro-nephrosis; and hæmorrhage into
the hydro-nephrotic sac may subsequently occur, the blood
being derived from the vessels in its wall.

In other cases, either as the effect of slight injury, or of
the congestion produced by torsion of the pedicle of a movable
kidney; or by the catamenial, pregnant, or parturient states, the
blood which escapes into the renal cavity may fail to find an
outlet to the bladder, owing either to the displacement itself or
to the blockage of the ureter by blood-clot.

Nephritis, which often co-exists with a stricture or valve of
the ureter, or with a calculus, is the immediate cause of the
hæmato-nephrosis in a certain number of instances.

In hæmorrhage from nephritis the obstruction to the outflow
of the blood may be due to the same cause as the nephritis
itself. In other cases of hæmato-nephrosis from nephritis, or
from injury, continued fever, or purpura, the coagulation of

the blood in the renal pelvis or ureter, or the blockage of the ureter by a small detached clot may be the cause of the obstruction.

Symptoms and diagnosis. — The symptoms of hæmato-nephrosis will depend greatly on the cause. They will most likely be rapid and severe when due to a ruptured artery, to a new growth in the kidney or ureter, to hæmorrhage during

Fig. 70.—Right Kidney of a man, æt. 25, who died of Purpura; the Pelvis and Calyces filled with a blood-clot. (St. Bartholomew's Hospital Museum.)

continued fever or purpura, or to that which ensues upon the emptying of a hydro-nephrosis. They may be slow and insidious, taking years to develop, when due to slight central lacerations or contusions from injury or from calculus.

In some cases there will have been hæmaturia, either continuous, relapsing, or intermittent, with long intervals between the discharges of blood. In some cases there has been pain with hæmaturia ; in some instances of uro-hæmato-nephrosis such attacks of hæmaturia and pain have extended over many years, as in Lauenstein's case. In other instances there have been no symptoms whatever ; the patients have died from other than renal causes, the tumour has been found as a surprise at the post-mortem examination, and inquiry has elicited no history whatever of any urinary symptoms. This was so in Loison's case.

The characters of and variations in the tumour formed by blood within the renal cavity are those of nephrectasis from obstructed urine, or pus, and having been described under hydro-nephrosis and pyo-nephrosis they need not be repeated.

Pathological anatomy.—The condition of the kidney and the character of the contents of the renal cavity differ in different cases. The extent to which the pyramidal and cortical substance is atrophied, the size of the tumour, if any exists, the relative proportion of distension of the several calyces and of the infundibulum, and the partial or complete obliteration of the ureter, all vary as in hydro-nephrosis and pyo-nephrosis. The contents may be pure blood, black or treacle-like and semi-liquid, or partly coagulated and partly liquid, or decolorised and deposited in concentric layers; or blood largely mixed with urine, in which case the fluid will be more or less limpid and of a brownish or blackish colour, very like thin coffee mixed with the dregs of coffee. If the condition has existed long, the renal parenchyma may have disappeared entirely, and the blood may have consolidated into a hard, nearly decolorised mass.

Prognosis.—The prognosis as to life depends upon the cause of the nephrectasis, and the severity and duration of the disease. If the ureter and renal pelvis remain patent, prolonged and frequently recurring hæmaturia may threaten or actually destroy life. When malignant disease is the cause of the hæmato-nephrosis death is likely to occur from the development of metastatic new growths. When the hæmorrhage comes from a large branch of the renal artery, extravasation of blood into the perinephric tissue is likely after a time to take place, owing to the rupture of the sac: this may lead to an enormous tumour and to death from the pressure effects of the tumour or from degenerative changes in the tumour itself. Life is best protected by sacrificing the kidney, or what remains of it, by performing nephrectomy. As regards the kidney, the prognosis is most unfavourable. The whole organ becomes irreparably destroyed if the blood accumulates in the renal pelvis, none of it being able to escape by the lower urinary passages. Even when the exit is not barred by obstruction in the ureter, the coagulum retained within the calyces impedes or prevents the renal function, besides forming a culture medium for bacteria, and predisposing to septic disorganisation of the kidney.

Nephrotomy for the removal of the blood from the renal cavity and for the purpose of restoring if possible the patency of the ureter may save the kidney for the time or altogether. But unless the primary cause of the nephrectasis can be removed, and a recurrence of the intrarenal hæmorrhage prevented, the subsequent destruction of the kidney or its removal by nephrectomy will be only temporarily avoided by opening and draining the renal cavity (see cases Nos. 38 and 39, Table IV., " Hunterian Lectures ").

Treatment. — It will be nearly always requisite if the kidney is to be preserved, and very often if life itself is to be saved, to resort to surgical treatment. If the hæmato-nephrosis is due to a remediable cause, such as a movable kidney, or a calculus ; or to a cause which, having once produced its effect, 'will not reproduce a similar effect after the extravasated blood has been removed, such as continued fever or purpura—nephrotomy followed by drainage and the fixation of the kidney, the removal of a calculus, or the division of a ureteral stricture or stenosis may effect a complete and permanent cure.

If, on the other hand, the cause of the condition is an intra-renal false aneurysm, or a new growth in the infundibulum or in the ureter, nephrectomy or nephro-ureterectomy will alone avail.

In other cases of traumatic hæmato-nephrosis in which the blood is not derived from a ruptured artery but from torn parenchyma or a ruptured vein, and in cases in which chronic nephritis of an obstructed kidney is the source of hæmorrhage, nephrectomy is the proper treatment if the opposite organ is sound.

If the patient's condition is not favourable to an operation, and if life is not for the time being threatened, it may be the surgeon's duty to stand by and watch the patient, well knowing, however, that the affected kidney will become ultimately destroyed ; but if nothing contra-indicates the operation, and the cause of the hæmato-nephrosis is a persistent and irremediable one, nephrectomy had much better be performed. If the cause is one dangerous to life, such as papilloma or carcinoma of the renal pelvis, nephrectomy at an early stage is the only chance of prolonging or saving the life of the patient.

CHAPTER XVI.

TUBERCULOSIS OF THE KIDNEY.

THE recent history of Renal Tuberculosis shows a very remarkable advance in the pathology and the treatment of this serious disease.

When I wrote on this subject sixteen years ago ("Surgical Diseases of the Kidney") tuberculous kidney was regarded more as a constitutional than as a local disease; "*strumous*" and "*scrofulous*" were terms applied to certain affections of joints, glands, the skin, and other parts and organs, as well as of the kidney and the rest of the genito-urinary tract, and the same words were used to express a certain constitutional tendency. Our knowledge of the pathology of these affections, although approaching towards correctness, was at that time far from being by any means precise; whilst the surgical treatment of renal tuberculosis was but tentative, and opinions were quite unsettled as to whether any operation whatever was justifiable, and if any, what operation was suitable for different kinds of cases.

The lesions grouped under the vague term scrofulous were not only ill-defined, but their relation etiologically, clinically, and pathologically to miliary tuberculosis was very imperfectly understood.

The results obtained by Villemin, from the inoculation of crude tubercle, had years before pointed to the infectiousness of tuberculosis. Klebs in 1877 had found that tubercle in human beings invariably contained bacteria, and that he could cause the same disease in other animals by inoculations of the cultures obtained from the bacteria. Other investigators found other microbes which they regarded as having a direct etiological bearing on tuberculosis, until at length Koch in 1882 made known to the profession that he had positively identified the special bacillus of tubercle. Koch's earlier investigations had reference to affections of the skin (lupus), glands, bones, and joints, though he subsequently found the bacilli in tuberculous pyelo-nephritis. In the same year (1882) Cohnheim pointed out that man could by means of his renal excretion eliminate the bacilli of tubercle

as well as other poisons; and he maintained that these bacilli could be transported from the lungs into the urine by the blood, and after reaching the bladder, could there excite tuberculous lesions without causing injury to, or infection of, the kidney in their passage. Kahlden, Cavazzani, Wyssokowitch, and Sherrington subsequently also affirmed that the bacillus of tubercle could filter through the kidney without causing tuberculous disease therein. Kahlden affirmed that this could happen without the kidney tissue being . in the least changed by the bacilli ; Cavazzani and Wyssokowitch that the bacilli could not pass without causing hæmorrhage and a lesion of the renal epithelium ; whilst Sherrington, disagreeing with these views, considered that the requirement to make the excretion of the bacilli possible was a change in the secreting tissues, whereby these tissues were made permeable, and that this change was effected by the virus of the micro-organisms. Sufficient attention, from the point of view of surgical prognosis, had not been given to the question whether renal tuberculosis is a *local* or *general* affection ; whether, in other words, from the point of view of treatment, tuberculosis is an *operable* or an *inoperable* disease.

Bayle and Rayer, it is true, had, in the early part of the nineteenth century, recognised the disease more or less as a local one. Lancereaux, in his work published in 1871, began to distinguish miliary tuberculosis originating through the circulation, from breaking-down tuberculous depots in the kidney commencing in the apices of the pyramids and spreading upwards towards the cortex, *i.e.* between medical and surgical forms of tuberculosis. Sayre and other surgeons were pointing out in reference to morbus coxæ and other so-called strumous joints that too much attention had been given to the constitutional aspect, to the exclusion of the importance of the local causes. Still, the constitutional element dominated the mind of the profession, and the exclusive localisation of tubercle in organs other than the lungs was barely recognised.

As to treatment, Bryant in 1870 had performed nephrotomy for tuberculous pyo-nephrosis. Clement Lucas in February, 1880, performed nephrectomy on a case presumably, though not actually stated to have been, tuberculous ; and the younger Gross of Philadelphia in July, 1885, collected twenty cases of nephrectomy for renal tuberculosis, of which twelve recovered

and eight died (a mortality of 40 per cent.). In January, 1885, appeared Part III. of Dickinson's great work on "Renal and Urinary Affections," in which he fully recognised that renal tuberculosis is a localised affection limited to one kidney about as frequently as it involves both kidneys; but, after stating that advanced renal tuberculosis was complicated with similar disease in other organs in six out of every seven cases—he expressed his opinion about nephrectomy for tuberculous affections in these words: "These facts would appear enough to discourage and probably to prohibit the operation."

The points which I endeavoured to indicate in "Surgical Diseases of the Kidney," written in 1884, were the following:—

1. Miliary tuberculosis of the kidney more frequently affects children, whereas the caseous form is generally met with in young, and middle adult life.

2. On post-mortem examinations the caseous form of renal tuberculosis is found to be unilateral nearly as often as bilateral.

3. Polyuria is sometimes a symptom of the early stages of tuberculous disease of the kidney.

4. Vesical irritation causing frequent micturition is a very usual, and often the most prominent symptom even when the bladder itself is not affected.

5. The ureter is often thickened and indurated in tuberculous disease to such an extent as to be clinically detectable, and even to be mistaken for impacted ureteral calculus.

6. Nephrectomy on the whole would prove to be the best operation for unilateral caseous renal tuberculosis; but in slight cases, erosion of the isolated abscesses or tuberculous foci; and in very advanced stages of the disease in debilitated persons, nephrotomy would be preferable to primary nephrectomy.

These views have been amply confirmed by subsequent investigations and experience.

In 1884 I also alluded to the fact that the bacillus of tubercle had been found in the urine of patients suffering from tuberculosis of the kidney; but at that time tuberculosis in all its forms had not come to be generally recognised as due to this particular micro-organism. Within the following two years, however, Durand Fardel (*Thèse de Paris*, 1886) and Cayla (*Thèse de Paris*, 1887) had demonstrated the mode of infection of the

kidney by the circulation, and the penetration of the bacilli from the blood-vessels into the renal parenchyma. The writings of Guyon, Vigneron, and others showed renal tuberculosis to be a localised disease often limited for a long period to one kidney. Tuffier in several literary contributions since 1891 has confirmed the teaching, now definitely accepted on all hands, that tuberculosis of the kidney is frequently a primary disease; whilst the operations of Tuffier, Küster, Israel, myself, and others have succeeded in establishing the operative treatment of caseous tuberculous kidney upon a sound basis.

To-day, thanks to bacteriology, to the high value of many research experiments, and to the number of admirable articles and theses which have been devoted to the subject, more especially by the French school, and thanks also to the great progress made in surgical therapeutics, tuberculosis of the kidney forms one of the best understood chapters in pathology and bacteriology ; and great unanimity prevails amongst surgeons as to the treatment best suited for the disease.

Etiology. — Renal tuberculosis is due to the presence of the tubercle bacillus, which may reach the kidney through the circulation or the lymphatics, or by way of the ureter by continuity from the bladder, prostate, seminal vesical, or urethra ; or across the capsule of the kidney by extension from a neighbouring or distant organ. When the infection is conveyed by the circulation, as it may be during either intra- or extra-uterine life, the disease may either run an acute course as a part of a general miliary tuberculosis, or a chronic form may occur and caseation result. In the latter case the caseated nodules may remain confined to the kidney substance, or they may extend into the calyces and give rise to a tuberculous pyelo-nephritis.

When the disease reaches the kidney from some of the lower parts of the genito-urinary tract by way of the ureter, which is a well-recognised process, but according to Tilden Brown not the most common mode of origin of the chronic forms, an ascending tuberculous uretero-pyelo-nephritis occurs, in which the kidney itself is the last portion of the urinary system to be affected. The disease may be conveyed along the walls of the ureter by continuity, or it may pass up along them by the lymphatic channels. It is important, however, to bear in mind that before the ascending mischief reaches the kidney, distinct foci in

the cortical substance may be formed independently by infection through the blood stream. More rarely the infection may be directly communicated to the ureter through some tuberculous focus situated altogether outside the genito-urinary tract, as was the case (to be again referred to under tuberculous disease of the ureter) in which an abscess arising from spinal caries penetrated the upper end of the ureter and finally reached the kidney.

Lastly, the kidney may become affected through direct continuity, as in a case recorded by Newman in which a tuberculous empyema perforated the diaphragm and gave rise to secondary renal infection. This mode of origin is certainly rare, and by some authors is not considered to be clearly proved. The renal capsule is said by Tilden Brown to offer the same protection against invasion as the dura mater does in cases of tuberculous disease of the bones of the skull. He points out (a) that sarcoma and adenoma most frequently affect first the upper part of the kidney, and that in a certain proportion of cases this invasion of the kidney across its fibrous capsule spreads from the supra-renal capsule; (b) that autopsies show often enough that an advanced tuberculosis of the supra-renal capsule gives no indication whatever of spreading through the fibrous capsule of the kidney to the renal parenchyma, yet that perinephric tuberculosis takes its rise frequently from disease in the supra-renal capsule; and (c) that one ought to be careful as to performing radical operations upon the kidney when a perinephric abscess of tuberculous nature has to be opened.

Any conditions which lower the resisting power of the individual either generally or locally will, as in tubercle elsewhere, act as predisposing causes. Thus retention of urine, as we have already seen in the chapter on pyelo-nephritis, favours the passage of micro-organisms through the ureter, while injury, such as a blow on the loin, will favour the growth of organisms which may reach the kidney through the circulation. In connection with the effects of injury it is important to note that the healthy kidney possesses a considerable amount of power of getting rid of various organisms which reach it by the blood stream; and among others tubercle bacilli may be excreted in this way. It will thus be seen that tubercle bacilli may possibly be found in the urine when there is no actual tuberculous lesion of the

genito-urinary tract. Fortunately, however, this possibility is not a fact of frequent importance in the diagnosis, because in tuberculous kidney a careful and if necessary oft-repeated examination of the urine in which bacilli have been found will almost always show some other abnormal constituents which will further support the diagnosis. When tubercle is suspected in any case of chronic renal disease, the presence of tubercle bacilli in the urine, together with pus or blood, may be fairly considered as pathognomonic of the disorder. But, although the experiments previously referred to (see p. 479) indicate that a patient the subject of general tuberculosis may have bacilli in his urine without having renal tuberculosis, there must not be too great a readiness to adopt this view in any particular case, even when no renal or urinary symptom exists; for the kidney may be considerably affected with tubercle without there being any other indication than the presence of the bacilli in the urine.*

Age.—The disease is most frequent in the young. This is more especially the case with the miliary form, since general tuberculosis is so frequent among children. The caseating form is also more frequent in youth and young adult life, but it may occur before five and after fifty years of age.

Sex.—The comparative frequency of renal tuberculosis in the two sexes is given differently by different authors. Fagge's, Tilden Brown's, Watson's and my own tables show men to be more frequently affected than women.

The joint statistics of Guillard, Tuffier and Albarran concern 246 cases of chronic tuberculosis, of which 117 were females and 69 males.

Fagge says, " It is at least twice as common in men as in women," and as to age he says, " Of twenty-nine cases at Guy's Hospital in which renal disease was the principal cause of death, in three death occurred between the ages of ten and twenty, in twelve between twenty-one and thirty, in eight between thirty and forty, in five between forty-one and fifty, and in one between fifty-one and sixty."

Albarran found that of 203 patients who were operated upon for tuberculous kidney, 148 were women and fifty-five men. This disproportion is probably due to the fact that the frequent co-existence of renal with vesical tuberculosis, or with the disease

* Tilden Brown: *Ann. des Mal. des Org. Génito-urinaires*, 1898, p. 587.

in some other part of the male genito-urinary organs, renders many men unfit subjects for operation.

The following statistics show the influence of various etiological factors. In ten years at the Middlesex Hospital forty-four cases of tuberculous disease of the kidneys were met with in 2,610 examinations. Of these forty-four cases twenty-nine were of the miliary and fifteen of the caseating form.

Of the twenty-nine cases of miliary tuberculosis eighteen were males, eleven females.

> 12 occurred in persons under 10 years of age.
> 8   ,,   between 10 and 30 years.
> 6   ,,   over 30 years of age.
> 3   ,,   whose age is not stated.

In *two* of the twenty-nine cases there was a spot or two (but not several) in one kidney, where small caseating nodules had been formed by the merging together of numbers of the miliary tubercles. In none of the twenty-nine cases were the kidneys the only organs affected; in the greater number there was acute tuberculosis of the viscera and serous membranes generally; in some the lungs, or lungs and larynx, were the only parts besides the kidney which were involved; the brain and its meninges were frequently complicated.

Of the twenty-nine cases both kidneys were diseased in twenty-eight; the right kidney alone in one.

Of the fifteen cases of caseating tuberculosis nine were males, six females.

> 7 occurred in persons over 30 (3 of them were over 50).
> 3   ,,   in adults whose ages are not stated.
> 5   ,,.   in persons between 11 and 30 years of age.

There was not one instance in a child younger than eleven years.

In 4 of the 15 cases there was chronic tuberculosis.

In 5 general tuberculosis of the genito-urinary organs existed; in only one of these were the kidneys the only organs affected, and in this case there was a large perinephric abscess; in the other 4 cases the lungs were affected with chronic tuberculosis.

In 2 there was caries of the spinal column, with more or less general tuberculosis of the other organs.

In 1 there was a suppurating elbow joint.

In 1 acute bronchitis and hypertrophy of the heart were present.

In 2 acute tuberculosis, chiefly involving the lungs and the liver, had supervened upon the longer-standing disease of the kidneys.

Of the fifteen cases both kidneys were diseased in eight, the left kidney only in four, and the right only in three.

In a further analysis of 3,331 cases from the post-mortem records of the Middlesex Hospital, there were only ten out of seventy-four cases in which the condition was limited to the kidney, while there were sixty-four in which the tuberculous deposit was part of a general infection. In nine of the ten cases in which the disease was limited to the kidneys, one organ only was affected, while in the sixty-four in which the deposit in the kidney was part of a general tuberculosis both kidneys were affected in forty-three; it will therefore be seen that the chances of one kidney only being diseased are very much less when there is tuberculosis of other organs of the body. Occasionally the kidney is found at an autopsy to be the only organ actively involved, but old foci of cured tubercle are found in the prostate, the testis, or the lungs. Israel also records such an instance.

Fischer, in " Urétérite Tuberculeuse " ("Thèse de Paris," 1892), records that in sixty-one cases of tuberculous disease of the kidney both kidneys, the ureters, and the bladder were affected in seventeen, and one kidney together with its ureter and the bladder were affected in twenty-eight cases (fifteen right side, thirteen left).

Dickinson tells us that " both kidneys are affected together in about as many instances as one separately. If only one be affected, it is more often the right than the left in adults, though in childhood this difference is not apparent. Of ninety-five cases, both kidneys were affected in forty-seven, one only in forty-eight."

Taking childhood apart from other periods of life, of twenty-eight children under twelve years of age, nineteen had both kidneys affected, five the right only and four the left only. Of sixty-seven persons over twelve years of age, twenty-eight were affected in both kidneys, twenty-two in the right only, and seventeen in the left only.

It must be borne in mind, however, that the multiple conditions found at death do not prove that the tuberculous disease was not for a time limited to one kidney and that from this source the disease was not disseminated to other organs and parts.

Tilden Brown found tuberculous lesions in sixty-eight out of 567 bodies examined at the Presbyterian Hospital between February, 1893, and May, 1896; of the total number presenting any

tuberculous lesions whatever the kidney was affected in twenty-three, and of these thirteen were males and ten females. In twelve of the sixty-eight subjects the spleen, and in nine the liver was involved. He remarks that the kidney in young children is less frequently affected with tubercle than either the spleen or the liver; whereas in adults it is the contrary; the reason assigned being the special function of excretion and a smaller power of antagonism to the action of the microbes and their toxines, which are eliminated by the kidneys.

The extremes of age at which the disease was observed in the kidneys were two and a half months and sixty-four years. Fourteen out of the twenty-three subjects were between the ages of twenty and fifty.

These figures contrast strongly with the statistics made in the middle of the century and for some years later when the post-mortem observation of tubercle was less careful and errors as to its recognition were more common. Thus, during 1849–50 Engel of Prague found only one case of renal tuberculosis in ninety-four autopsies on tuberculous subjects; and Willingk in 1850–52 found only seven in 452 tuberculous subjects. Chambers, on the other hand, in 1852 found ninety-one cases of renal tuberculosis in 503 tuberculous subjects.

Watson[*] was able to determine the primary seat of the tubercle in fourteen out of twenty-one cases of tuberculous disease of the genito-urinary organs which he had an opportunity of observing. Of these fourteen, seven commenced in the epididymis, four in the prostate or vesiculæ seminales, and three in the kidney itself; in the remainder the exact origin could not be determined. Of these twenty-one cases there were fifteen males and six females. The oldest was a man of fifty who developed symptoms of prostatic disease two years before his death; the youngest was a girl of six in whom the disease was primary in the kidney.

Vigneron's [†] collected statistics, which include those of Roberts, Dickinson, Gaultier, Guyon, and my own earlier ones, show that in the caseating form of the disease one kidney is affected in about half the total number of cases. Thus in 205 cases the disease was unilateral in ninety-nine.

The late results of many nephrectomies and of some partial

---

[*] *Boston Medical and Surgical Journal*, 1895, p. 121.
[†] "Thèse de Paris," 1892.

nephrectomies have proved that if the disease was not limited to the excised kidney the other tuberculous focus (if any) which may have been present has given no trouble, as perfect health has been for many years enjoyed by the patients after the operation. It would certainly seem from these results of operations that renal tuberculosis is much more frequently a local primary disease of the kidney than the results of autopsies, made as they necessarily are at a very late stage of the affection, formerly led us to believe.

Albarran states that in twenty-one out of thirty-two specimens of renal tuberculosis preserved in the Musée Guyon, with reference to which the condition of both kidneys is stated, one kidney only was affected.

In fifty consecutive cases of renal tuberculosis of all varieties taken from the post-mortem records of the Middlesex Hospital, the cortex was alone affected in eight, the medulla alone in seven, while both parts were attacked in the remaining thirty-five.

It would appear from these various figures (a) that miliary tuberculosis is twice as common as the caseating form ; (b) that miliary tuberculosis affects children under ten years of age in a large proportion of cases, whereas the caseous variety is at least somewhat exceptional in children below ten years of age ; (c) that miliary tuberculosis with rare exceptions affects both kidneys, though not to an equal degree in all cases; whereas the caseating form affects both kidneys only a little more often than it does one kidney alone ; (d) that the caseating form of the disease is more especially an affection of young and middle adult life, but occurs also in persons past middle age.

Pathology.—Pathological anatomy teaches us that the kidney is often affected with tubercle without either the ureter or the bladder being involved. It also teaches us that when tubercle commences in the kidney the disease may spread in a descending manner along the ureter to the bladder. It shows us also that miliary tubercle follows the course of the blood-vessels of the parenchyma, often starting about the vessels of the Malpighian tufts. Experimental pathology also has demonstrated the circulatory origin of renal tuberculosis, and has shown further that dead micro-organisms, as well as living active bacilli, may be the cause of the early cellular proliferation of the tuberculous process. Pathological anatomy shows us also that the

ureter and kidney can be secondarily invaded in an ascending manner by the extension of tuberculous disease from the bladder, and that when this is the mode of origin of the disease in the kidney the morbid process spreads from the apices of the pyramids into the renal parenchyma, until at length the whole organ may be converted into a number of vomicæ. Albarran and Cottet (Soc. Anatomique, 1898) have recorded a very beautiful example in proof of this mode of extension from the bladder.

A man, with advanced widespread vesical tuberculosis had three ureters, two of which opened into the bladder where the tuberculous affection was very pronounced ; along each of these ureters the disease had ascended and had attacked the whole of the kidney with the single ureter, and the part of the kidney with the double ureter which had been drained by the affected ureter. The third ureter opened upon a healthy part of the bladder and was itself, as also was the corresponding part of the kidney, quite healthy.

Israel met with two post-mortem subjects in which the tuberculous lesions were limited to one kidney, its ureter, and the area of the bladder about the corresponding ureteral orifice.

Tuberculous lesions may also occur simultaneously and independently in the kidney and in the bladder or some other part of the genito-urinary apparatus ; the renal lesions are then neither the cause nor the consequence of the vesical lesions, and the disease cannot be placed in either of the two categories—ascending or descending tuberculosis—though it is possible that the blood by which the bacillus is conveyed to the kidney has been infected by the lesion in the lower organs.

It is not difficult, generally, when examining a tuberculous kidney which has been removed from the body, to say what has been the mode of infection. When by the blood, miliary tubercles are found in the cortical substance ; the caseous nodules are older and wider about the bases of the pyramids than at the apices ; and if they are broken down and have opened into the calyces, the openings of the vomicæ are small, even though the parenchyma may be almost entirely destroyed. Moreover, there may be little or no extension of the diseased process into the renal pelvis or the ureter.

When the disease is of the ascending type the ureter and renal pelvis are indurated, thickened, and perhaps ulcerated, with a

quantity of cheesy material in their walls or in their lumen. The calyces share in these changes: the connective tissue and urinary tubes become invaded from below upwards; the vessels become obliterated, minute hæmorrhages occur into the tissue, and the breaking-down process spreads upwards along the pyramids from apices to bases till large vomicæ are formed in the kidney which communicate with the renal pelvis by wide openings.

As soon as the bacilli or their proteids have excited the connective tissue corpuscles and the endothelial cells to proliferate, epithelioid and giant cells are produced which often enclose one or more of the bacilli of Koch, and lymphoid corpuscles and leucocytes are multiplied and scattered thickly at the circumference of the little mass, the centre of which is formed by an occluded vessel stuffed with endothelial cells. In this way is formed the typical miliary tubercle ; and these uniting form grey and yellow nodules of various sizes ; then coagulation necrosis following caseating masses result. These masses, sometimes involving the whole kidney, are not unlike in appearance to the contents of some dermoid cysts. Where these caseous masses have sufficiently increased at the expense of the surrounding tissues and softened down, they may break through into the calyces and discharge into the renal pelvis and ureter, or more rarely through the fibrous capsule of the kidney, and give rise to tuberculous perinephritis.

In other cases the disease, owing probably to the impaired virulence of the bacilli in relation to the tissues of the individual attacked, may take the form of an infiltrating intertubular tuberculous cirrhosis. If the tuberculous foci are invaded by pyogenic organisms, large abscesses may result ; if the ureter becomes occluded either by ascending ureteritis or (when the tuberculosis is primarily renal) by the impaction in the lumen of the ureter of caseous material or lime salts, tuberculous pyonephrosis may thus be caused.

Tuberculous hydro-nephrosis is most likely to arise from obstruction of the ureter by ascending tuberculous ureteritis. It can be ascertained by the microscope and inoculation that the clear yellow urine which is pent up within a hydro-nephrotic kidney *in cases of ascending tuberculosis* contains the tubercle bacilli, but no other micro-organism. Klippel has reported a case in which the whole kidney was transformed into a polycystic mass and a tuberculous

" cystic degeneration " existed without there being any obstruction of the ureter.

Certain very rare forms of renal tuberculosis have been described. Rayer mentions an ecchymotic variety of renal tuberculosis ; Johnson a renal epithelial tuberculosis ; Coffin a special tuberculous nephritis caused by compression of the uriniferous tubules by sclerosis. Cornil and Brault, and Durand-Fardel describe a glomerulo-tuberculosis in which the glomeruli alone are invaded by the tubercle, the capsule of Bowman being stuffed with endothelial cells by which the Malpighian tufts are compressed and finally obliterated.

It is not always easy when operating, or even when making a post-mortem inspection, to be sure by microscopic examination that a lesion is tuberculous. This is especially the case if the lesions are small in size, or if suppuration has supervened and altered, as it is pretty sure to do, the character of the initial lesion.

The lesions most likely to be mistaken for tubercle are those wrought by the bacillus coli communis and staphylococcus ; the minute suppurating foci met with in kidneys wrongly known as " surgical kidneys"; and, more rarely, the disseminated foci of carcinoma and epithelial adenoma and some of the changes made in the kidney by syphilis, malaria and leprosy.

The *malarial foci* are of the size of pins' heads and are formed of embryonic cells and leucocytes infiltrating the cellular tissue around the obliterated blood-vessels ; they never caseate or suppurate. They are often associated with hæmaturia during life. Osler speaks of occlusion of the small renal arteries by the parasite of malaria as being comparatively frequent.

It is important for the surgeon, when operating, to remember that a kidney may be the seat of extensive discrete miliary tuberculosis without any evidence of the tubercle appearing on the surface of the organ. Occasionally it is only on section of the kidney and after compressing the renal artery that miliary foci are seen, and then only on the cut surface.

Acute miliary tuberculosis of the kidneys as part of a general infection is very common in young children who are very prone to general tuberculosis. The tubercles appear as minute translucent grey granulations the size of a pin's head and vary in number from one or two up to any number. The infection is brought to the kidneys by the blood-stream and the tubercles

tend to follow the lines of the arterioles. The earliest deposits
are usually found in the cortex, but later they may be scattered
throughout ·the entire organ and tend to spread downwards
into the ureter and bladder and also to involve the vesiculæ sem-
inales, prostate and testes. This variety of the disease does not
give rise to any symptoms directly referrible to the kidney, nor
does it come within the scope of surgical treatment.

Infiltrating or caseating tuberculosis. — This form runs a
chronic course and is characterised by the formation of caseous
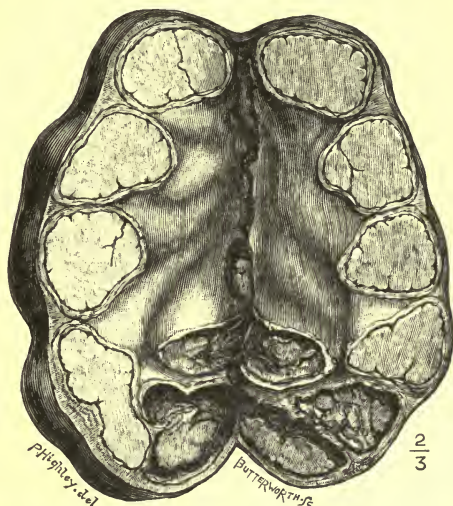
Fig. 71.—Tuberculous Kidney showing numerous caseous deposits. (Middlesex
Hospital Museum.)

nodules within the kidney substance. The disease may for a
time be localised in the kidney, but post-mortem examinations
show that in the majority of cases some adjacent parts of the
genito-urinary tract are ultimately also affected ; where both
kidneys are affected the disease in the second usually arises as
an ascending tuberculous uretero-pyelo-nephritis, and is generally
much less extensive than in the first.

The body of the kidney is often enlarged, and may become
lobulated by the extension of cheesy infiltration into the cortical
parts of the organ ; and on section, conical masses of this cheesy
material in different stages of softening are found to correspond
to the prominences of the lobules (Fig. 71). The pelvis of the
kidney and its ureter, on the other hand, may be contracted by the

thickening of their mucous and submucous membranes ; and at a later period the mucous membrane ulcerates, and the lumen of the tube is choked by the softened caseous or putty-like substance which escapes into it. Thus, often both the mucous membrane lining the pelvis and infundibulum and the secreting and tubular substance of the kidney are affected ; and the organ is converted into a huge abscess cavity, or into a series of large irregular abscess cavities with softened caseous or puriform *débris* for contents. These contents can be readily washed away, and leave exposed white shaggy ulcerated walls in which there is scarcely any, if any, renal structure traceable. In some cases the kidney becomes a mere shrunken putty-like mass in which abundance of cholesterine or calcareous nodules are formed in the lobulated spaces.

The renal parenchyma between the tuberculous foci may be in some places quite or almost healthy, in others interstitial sclerosis may exist, and in others the tubules may be dilated and stuffed with degenerated epithelial cells. The ultimate shape and condition of the kidney in these cases vary considerably, and depend to some extent upon the condition of the ureter.

When there are only a few discrete caseous nodules scattered throughout the organ the progress is often very slow, and in some cases it may become arrested by calcification of the nodules, or by fibroid changes taking place around them, just as tuberculous foci in the lung are arrested. Some amount of calcification in these cases is not at all uncommon, but it is rare for fibroid changes to be sufficiently marked to exert any definite influence on the course of the disease. When the ureter is occluded the kidney often becomes greatly enlarged, and eventually is converted into a mere sac partially loculated and tightly distended with a thick white putty substance which has entirely replaced the kidney substance proper ; it is to this variety that the term " massive tuberculous degeneration " has been applied.

Much more rarely, occlusion of the ureter is followed by tuberculous hydro-nephrosis. It is, however, more common to find a pyelo-nephritis with a considerable distension of the renal pelvis.

Chronic tuberculous disease of the kidney, if it spreads beyond the capsule of the organ, may sometimes, invade the liver or the spleen. In the patient from whom the organs illustrated in Figures 72 and 73 were taken, the upper half

of the right kidney had been completely destroyed, and the disease had spread by contiguity to the under surface of the liver. The lower half of the right kidney was quite healthy.

The presence of tubercle in the kidney and the congested condition of the parts which tubercle induces create a ground admirably suitable for the growth and multiplication of secondary infective agents, such as the coli bacillus, the staphylococcus and
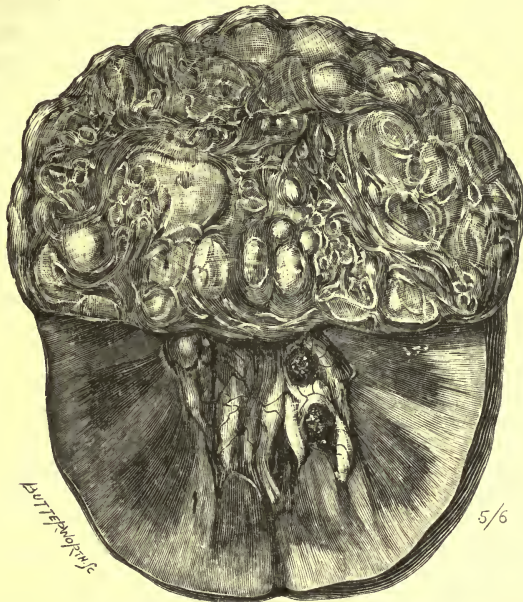

Fig. 72.—Tuberculous Right Kidney, from the same patient as Fig. 73. Only the upper half of the organ is involved.

streptococcus, and the bacillus septicus liquefaciens, which is also found in the kidney in cases of secondary infection; so that if there is present cystitis or suppuration in any of the lower urinary organs, or in any more remote part, the kidney, even though but slightly tuberculous, becomes thereby all the more prone to secondary infection, by the micro-organisms ascending the ureter or circulating in the blood. The tuberculous and the pyogenic infection re-act unfavourably to the patient on one another; the clinical course of the tubercle is rendered more acute, and on the other hand the lesions caused by the pyogenic infection are more serious and persistent than in ordinary cases of suppuration. Hence we find very extensive changes

not only in the kidney, ureter, and bladder themselves, but in
the cellular tissue enveloping them. Peri-ureteritis and peri-
nephritis are often present in a very aggravated form.

Other variations in the external and internal appearances
are produced by secondary infections becoming imposed upon
the primary tuberculous lesions.

Complications.—The most important point for consideration
in every case of chronic renal tuberculosis, more especially
when a surgical operation is contemplated, is the probable
condition of the *opposite kidney.* As we have already seen

Fig. 73.—Portion of Liver involved by contiguity with the Tuberculous Right
Kidney shown in Fig. 72.

from post-mortem records, both kidneys are affected in about
half the total number of cases, but not to an equal degree, so
that when patients first come under treatment, unilateral renal
tuberculosis is no doubt much more frequent than bilateral.
When considered in relation to the possibilities of relief being
afforded by operation, figures taken from post-mortem records
must be considerably modified, and Tuffier and Albarran are of
opinion that tuberculosis of the second kidney is only a contra-
indication to operation in about 17 per cent. of the cases. But
besides tuberculosis of the second kidney, the possibilities of other
forms of renal disease must also be borne in mind, such as pyelo-
nephritis, nephritis, and lardaceous disease, which is not at all
unfrequent in long-standing cases. There are also often present
tuberculous deposits in *other parts of the genito-urinary tract;*

the vesiculæ seminales, vas deferens, and epididymis are all frequently the seat of such deposits. The bladder is also often affected, and Vigneron found it diseased in twelve out of twenty-three cases. Lastly, there may be old or recent tuberculosis of *other organs of the body*, such as the lungs, pleura, or intestines.

Unilateral renal tuberculosis co-existed with epithelioma of the same kidney in a case observed by Albarran. A tuberculous kidney was found in an elderly man in whom, eighteen months before death, I had established a supra-pubic fistula on account of carcinoma of the bladder.

In cases of renal tuberculosis of long standing, there are usually considerable changes produced in the *peri-nephric tissue*, which result in the formation of a chronic peri-nephritis of either the sclerosing type or, what is very common, the fibro-lipomatous variety. In some of these cases the peri-renal tissue becomes greatly increased in volume, forming enormous masses which may give rise to a very definite tumour, though the kidney itself is but little if at all enlarged. Tuffier has described under the name of " fungating " a tuberculous peri-nephritis which arises by direct infection of the surrounding tissues after nephrotomy has been performed. A tuberculous abscess of the peri-renal tissue is rare, and when it occurs it often communicates directly with an abscess cavity in the kidney. Firm adhesions may occur between the renal pelvis and surrounding parts, and one case has been recorded (Bang) in which an enormously distended pelvis formed a fistula with the duodenum. The kidney may be fused with the vena cava or aorta by means of the sclerosing perinephritis, and when this is so, though the kidney can be easily enucleated from its own capsule, the capsule itself cannot safely be removed from its surroundings.

The *lymphatic glands* at the hilum of the kidney may also become infected and form firm adhesions with the organs around.

Changes in *the ureter* caused by ascending and descending tuberculous ureteritis are the almost habitual accompaniments of renal tuberculosis.

Symptoms.—Taken together, the symptoms in a typical case of renal tuberculosis are very characteristic, though it must be allowed that in many cases in which some or all of the symptoms are entirely absent or but little marked, the difficulty of

diagnosis is considerable. There are cases in which persons who are known to be tuberculous and who die from this disease have never had any symptom referrible to the kidney, and no change in micturition or in the urine (except possibly the occasional presence of bacilli), and yet both kidneys have been the seat of tubercle. A striking and well-recorded case has been published by Tilden Brown.

The various symptoms to which renal tuberculosis may give rise are the following : lumbar pain, dysuria, polyuria, frequent micturition by night as well as by day, pyuria with acid urine, hæmaturia with acid urine, the presence of tubercle bacilli in the urine, pallor, loss of flesh, night sweats, some elevation of temperature especially in the evening, œdema of feet, the occasional presence of albumen apart from that due to pus or blood, and the reaction to the injection of tuberculin.

The symptoms, in the early stages of the disease, vary according to the mode of invasion. The infection through the blood may cause no local or urinary symptoms for a time, at least, until the calyces become invaded or a tumour is formed. Thus acute miliary tuberculosis of the kidney, occurring as part of a widespread tuberculosis, produces no characteristic symptoms referrible to that organ.

The symptoms of the chronic infiltrating or caseating form (the so-called strumous kidney) are often slow in developing and may not be at all severe until the disease is well advanced.

Pain in the loins is sometimes the earliest symptom complained of ; it is long-continued, of moderate intensity, and not as a rule particularly influenced by movement. When the disease becomes well advanced the pain is usually greater and forces the sufferer to seek relief, so that when a patient is first seen the common history is that he has suffered from pain in the loins for a variable length of time—it may be for some months or some years—which has lately increased very much in intensity. The pain is often referred to one loin, occasionally it is referred to the pelvis, or there may be acute exacerbations accompanied by vomiting which closely resemble nephritic colic due to calculus. Colic is sometimes caused by the passage of small caseous masses along the ureter, which is sometimes temporarily blocked by them. There is usually tenderness on palpating the affected region.

Tumour.—Some increase in volume of the kidney is exceed-

ingly common ; and in a large number of cases, though there is no hydro- or pyo-nephrosis, the tuberculous kidney causes a tumour which can be detected on palpation by the movement known as *ballottement*). A tumour may form insidiously and be the only symptom. There may be an indistinct swelling or sense of resistance, accompanied by an increased area of renal dulness, and in many cases a definite tumour can be felt. In others, there are no local signs to be made out at any period of the disease. In' some cases a tumour seems to exist when there is no actual enlargement of the kidney itself : this is due to the effects of perinephritis, and it explains the surprise sometimes expressed at operations when the kidney which has been thought to be greatly enlarged is found of normal size on exposure.

When the kidney is enlarged by tubercle the tumour may be regular and retain the outline of the organ ; or it may be irregular on its surface from the prominence of masses of caseous material in the parenchyma. A large chronic tuberculous abscess may expand at one part of the organ and give it an abnormal outline. An enormous hydro- or pyo-nephrosis may destroy the renal shape and give the tumour a rounded, smooth, and elastic character.

The tumour may be painless, or on the other hand tender and painful. The pain may be local, or radiate to the groin and thigh and in various directions in the loin and abdomen. It may be continuous or intermittent, spontaneous or only invoked by movements, pressure, or manipulation.

Tumour is more commonly a symptom of the middle and later stages of both forms of tuberculous kidney. When the infection proceeds upwards, however, partial obstruction of the ureter may give rise to an intermittent or continuous hydronephrosis before the kidney becomes affected with tubercle.

If the disease be on the left side the spleen may be so much pushed forward as at first sight to give the impression that the tumour is an enlargement of that organ. In one instance which I have seen a small ague-cake existed and masked a large tuberculous kidney.

The urine.—Polyuria is a frequent and early symptom of renal tuberculosis ; it shows itself sometimes in fits and starts, and its occurrence is often accompanied by dysuria. There may be no other symptom of any kind in the early stage of the disease,

and when it occurs in a patient of weakly constitution and of a tuberculous stock and no other cause for it is assignable, suspicion of incipient renal tuberculosis ought to be aroused. In the late stage of the disease the quantity of urine passed is often below the normal.

The urine may not show any definite alterations in quantity or quality during the early stages, but later it becomes cloudy and contains varying quantities of pus and blood, and sometimes *débris* of renal tissue and minute cheesy masses. The polyuria sometimes met with in the earlier stages may cease, or give place to anuria in the late stages. The reaction is nearly always acid, but may become neutral or slightly alkaline, especially in the later stages. The quantity of urea and of the phosphates is often much diminished. Epithelial cells from the tubules or pelvis of the kidney, and occasionally hyaline or granular casts, are found; but these if present in quantity point to nephritis, which not very rarely co-exists with renal tuberculosis.

A partial occlusion of the ureter which not unfrequently accompanies ascending tuberculosis may for a time become complete, and in this way the appearance and composition of the urine may show great variations: at one time being thick and at another clear according to whether the duct from the diseased kidney is partially or completely blocked.

Pyuria.—Although the bacilli of tubercle are non-pyogenic, still in nearly every case of renal tuberculosis there comes a period when pus is present in the urine, or at any rate leucocytes resembling pus. The urine containing the pus is acid, and the pus is frequently sterile. When the disease begins in the kidney, pus may be absent for a long time, until the tuberculous process reaches the calyces, and then pyuria will appear. In the ascending form of renal tuberculosis, pus will be present in the urine before the tubercular affection involves the kidney. According to Watson, the pus differs from that of other forms of pyuria in that it has a peculiar dirty grey colour, and also in the fact that tuberculous urines even when loaded with pus do not often have the exceedingly foul smell that is so generally noticed in the urine of cases of chronic cystitis due to stricture, enlarged prostate, and malignant disease of the urinary organs. Mixed with the pus sometimes there may be small mortary phosphatic masses in some of which bacilli may be found.

Hæmaturia is not unfrequently the earliest symptom of the disease, and in most cases traces of blood can be found in the urine from time to time ; the blood is intimately mixed throughout with the urine. It is often present with pyuria. Occasionally the hæmorrhage is very severe, and may be prolonged for weeks or months. It has been known to be so violent and persistent as actually to endanger life, but this is most exceptional. The cases of excessive hæmaturia have often been those in which the disease is not far advanced, or is of the miliary type. But it occurs also in · advanced cases where the kidney is dilated and breaking down, as in those recorded by Habershon in 1880, and Czerny, which were the first of the kind published. It is said to be more frequent and abundant in tuberculosis of circulatory origin than of the ascending form. It may be so small in quantity as to require the microscope for its detection ; or it may be only faintly visible to the naked eye when the urine is first passed, and become evident enough after being deposited as reddish streaks or as a reddish layer in the thick purulent sediment. Fagge says, " Hæmaturia is neither constant nor profuse. Among eighteen fatal cases, with notes of the symptoms during life, which occurred at Guy's Hospital, in only ten is blood said to have been at any time observed in the urine ; and in most of these cases the bladder was likewise affected with tuberculous disease, so that the exact source of hæmorrhage was, after all, doubtful." Sometimes clots of blood are voided, and their passage down the ureter is often attended with much pain or with actual colic. The hæmaturia is in many cases intermittent and quite independent of rest or exercise.

The presence of bacilli of Koch is of the very first importance ; not so their absence. Tilden Brown points out that it is just after an attack of hæmaturia that the condition of the urine is most favourable to the discovery of the bacilli. Tuffier thinks it is in the deposit of purulent urines that they ought to be searched for; whilst Albarran, on the other hand, emphasises the necessity of searching for them whilst the urine is fresh and acid, and says that it is best to centrifugalise the fresh urine and examine carefully the caseous particles brought down.

It is absolutely necessary to examine many specimens, for no matter what may be the state of the urine which is examined

the bacilli will often escape detection. They may be found in several slides of the same specimen, or in only one out of a dozen, or they may elude a prolonged and careful search in one sample and be readily found in another. They are often absent from the urine in cases of primary renal tuberculosis and in cases of descending tuberculosis if the ureter is blocked.

They are sometimes detected by inoculation experiments with urine in which they are not found by staining and microscopical examination. In the case of a man upon whom I performed partial, and afterwards total nephrectomy the urine was examined by Mr. Foulerton before the first operation. Two hundred cubic centimetres of the urine were centrifugalised for fifteen minutes, the machine running at about 1,500 revolutions per minute. From the small sediment thus obtained twelve cover-glass films were prepared and examined; on one only of these cover-glasses a few specimens of bacilli tuberculosis were found.

Three guinea-pigs, of about 250 grammes weight, were inoculated in the inguinal region with portions of this sediment. Of these animals one died on the fourth and another on the fourteenth day after inoculation, neither of them showing any sign indicative of tubercular infection. The third guinea-pig was killed, whilst still apparently well, on the thirty-second day after inoculation. The spleen contained a large number of small tubercles in which bacillus tuberculosis was identified on microscopic examination. There was no obvious tuberculous lesion at the site of inoculation. The cover-glasses had been examined, and a negative report sent to me before the results of the inoculation experiments were known, and it was only after some of the cover-glasses had been re-examined that the bacillus was discovered by the microscope in just one of the specimens. The above case shows the difficulty of detecting the bacillus with the microscope, and the necessity, when making an inoculation experiment, of injecting several guinea-pigs instead of only one.

Besides the bacillus of Koch, there may be present in the urine in the advanced stages of the disease the ordinary bacilli of suppuration—the coli bacillus, the staphylococci, and the streptococci. When none of these other microbes are present in acid purulent urine the diagnosis of tubercle becomes greatly strengthened if other symptoms of tuberculous kidney exist, even without the evidence afforded by the bacilli of tubercle.

The smegma bacillus may be mistaken for the bacillus of Koch. Leyden, Koch, König, and others have failed in distinguishing them by colouring and the microscope. Inoculation is the only sure test. Fraenkel, however, claims that they can be distinguished by the method of Ehrlich—the bacillus of smegma being decolorised when the preparation is treated by nitric acid. The mistake is most likely to occur in females and in males with very long prepuce.

It has been previously stated that sometimes persons with general tuberculosis have bacilli in their urine without having tuberculous kidneys.

Albuminuria.—When the tuberculous deposits in the kidney are in connection with the renal infundibulum and ureter, albuminuria is almost a constant symptom as representing the admixture of serum and blood corpuscles and leucocytes which then escapes with the urine. But when the lesions are limited to the renal parenchyma albuminuria is rare, and if present indicates a degree of nephritis superadded to the tuberculosis. This nephritis may be brought about by the strain upon the still uninvolved tubules owing to the extra work forced upon them and the large amount of septic products they have to eliminate.

It has been thought that if we could distinguish clearly between globulin and true albumen in urine, we should have an aid in making a diagnosis between Bright's disease and tuberculous nephritis.

Frequent micturition and dysuria.—Without the presence of any disease in the lower urinary organs, there may be an undue sensitiveness, sometimes amounting to actual acute pain, when passing water. This is in some cases, perhaps, the result of the over-activity and consequent hyperæmia of the neck of the bladder when polyuria or frequent micturition are present; but there is pain at the neck of the bladder and along the urethra also complained of by patients who have neither polyuria nor vesical disease.

Vesical irritation is quite usual, and in some cases has been the most prominent and a very early as well as a very distressing symptom. A man was under my care who passed water with much pain and spasm on an average 160 times in twenty-four hours. At the post-mortem examination there was found tuberculous disease of the kidneys and ureter, the bladder having only

quite recently become affected.   In another case micturition was
incessant until the kidney was opened and drained.   Dickinson
goes so far as to say that the absence of vesical symptoms in the
presence of pus from the kidney would indicate pretty certainly
that the case is not tubercular.   The converse of this, however,
is certainly not true.

Frequency of micturition, besides being often the earliest
symptom, may for a long time be the only one.   It occurs during
the night as well as in the daytime.   Nocturnal frequency of
micturition in a person between twenty and forty years of age
should always excite the suspicion of renal tubercle.

Instead of frequent and painful micturition being caused by
either polyuria or reflex irritation, it may be due to co-existing
tuberculous deposit in the bladder, or to tuberculous cystitis, or
to an ordinary cystitis caused by infection with pyogenic
microbes.   These vesical conditions may be secondary to the
renal disease or independent of it.   Daily experience, however,
proves that the bladder may be for a very long period in con-
tact with urine infected with the bacilli of Koch or with other
micro-organisms without itself becoming infected.

Another cause of frequent and painful micturition is the
accumulation in the bladder of masses of soft phosphatic particles
blended with muco-pus, or caseous material and *débris* of renal
tissue.   In the case of a young woman whose left kidney I re-
moved for tuberculous disease micturition continued to be frequent
and painful after the operation until I discovered and removed
from the bladder about ten days after the nephrectomy several
masses of this material, the size of or larger than dried raisins, yet
this lady's bladder had been inspected and these masses over-
looked only a day or two before the operation by a skilled
cystoscopist.

The reaction of tuberculin has been but rarely employed
as a means to diagnosis of tuberculosis in man ; its use should
be very restricted, and the results of Escherich's clinical obser-
vations would lead us to attach very limited importance to its
diagnostic power in man, whatever may be its value in bovine
tuberculosis.

General symptoms. — The evening temperature even in the
early stages of latent renal tuberculosis is in some cases con-
stantly somewhat elevated.   If the tuberculous kidney is also

suppurating the evening temperature may be much higher— though one or· more chronic or cold abscesses may occur without any rise of temperature. In general tuberculosis and in tuberculosis localised in the kidney, when there is much destruction of tissue and septic infection, the evening temperature may rise to 103° or 104° F., and the morning temperature to 1° or $1\frac{1}{2}$° above normal.

Loss of flesh, loss of appetite, diarrhœa, a sallow or pale skin, and, very rarely, œdema of the feet are symptoms indicative of a general anæmic state, which may precede any local or urinary symptom; but they are more likely to occur after the disease has existed for some time, and to increase as the disease progresses. When frequent and painful micturition occurs the patient rapidly loses ground owing to the pain and loss of rest which it entails.

In the advanced stages there are marked rigors and exhausting sweats or hectic temperature. The temperature may be such as is seen in ague or septicæmia, or there may be intermittent periods of high fever lasting for two, three, or four consecutive days.

These attacks of high fever are indicative of temporary obstruction in the ureter, and are apt to be associated with lumbar pain, general malaise, loss of appetite, an increase of dulness and resistance, or possibly the presence of a distinct tumour in the renal region, together with a marked improvement in the urine which, if the opposite kidney and the bladder are unaffected, will become quite normal and remain so until the ureteral block is removed. Retention of the urine may follow obstruction of the ureter by caseous masses, and if the opposite kidney is absent or destroyed by disease, or if there is but a single kidney, a condition of anuria analogous to that produced by a calculus will result.

Intermittent pyo-nephrosis from partial obstruction of the ureter is important clinically from the fact that some knowledge of the state of the opposite kidney may be obtained by examination of the urine passed in the intervals between the attacks of pyuria.

When suppuration is superadded to renal tuberculosis the greater part of the general symptoms may be due to the secondary and not to the tuberculous infection. In fact, it is difficult to say how much of either the local or general phenomena

is due to the one cause or to the other; and yet it is a matter of importance to know this when considering the question of surgical treatment. For example, in the case of pyo-nephrosis in a slightly tuberculous kidney nephrotomy and erasion may suffice, whereas if the disease be entirely tuberculous nephrectomy would be requisite. So in the case of the ureter and the bladder, a septically infective state of either may be entirely and rapidly recovered from, whereas a tuberculous ureter will require removal, and a tuberculous bladder will probably contra-indicate any operation.

Diagnosis.—The early diagnosis of renal tuberculosis is of very great importance; and if this is made, the patient may be saved the necessity of subsequent partial or entire nephrectomy by being sent to a suitable climate and placed under proper dietetic and hygienic conditions.

The diagnosis is, however, frequently very difficult, and it is only by an accurate knowledge of the various symptoms above related that it can be arrived at correctly. When there is frequent micturition, or polyuria, or pyuria, or hæmaturia in an acid urine, together with an elevation of the evening temperature; when the pyuria is persistent and the hæmorrhage uninfluenced by rest or movement; when the patient is pallid and losing flesh, and especially if he comes from a tuberculous family, and if there is fulness or a tumour with or without pain in the renal region, and tubercle bacilli are found in the urine, we have an assemblage of symptoms which are sufficiently characteristic. On the other hand, all these symptoms may be absent in the early stages of the disease and occasionally throughout its whole course; and the bacilli of Koch, though positively proved by inoculation to be such and not the bacillus of smegma, may be present in the urine without either of the kidneys or ureters or the bladder being the seat of tubercle.

In the diagnosis of tuberculous kidney *from simple or suppurative pyelo-nephritis* much assistance will be given by the antecedent history of the patient, by family history, by the development of the disease, by the discovery of other tuberculous lesions, by careful examination of the lungs, the testes, prostate, and seminal vesicles, by finding a thickened irregular nodular state of the ureter, by abdominal rectal or vaginal palpation, and above all by discovering the tubercle bacilli in the urine.

Bloch of Copenhagen has proposed cutting out and microscopically examining a portion of the affected parenchyma, after exposing the kidney by lumbar incision. This might be done with advantage in exceptional cases before sacrificing a very doubtful kidney to nephrectomy ; but it is rarely feasible in practice.

From renal calculus.—In the early stages of the disease it is difficult if not impossible in the absence of the bacilli of tubercle to diagnose tuberculous kidney from renal calculus. The chief reliance must be placed on the constitutional signs of tuberculosis : a poor and weakly physique with existing or threatening or past lung symptoms, in a person between ten and fifty years old who is suffering from suppurative pyelitis with an irregular and occasionally high temperature, and with vesical irritation, are pretty sure indications of tuberculous kidney. The bladder symptoms are often the most prominent, and no relief from pain in the hypogastrium and the neck of the bladder is experienced except when the bladder is empty. In stone there is more likely to be hæmaturia brought on by exercise or exertion and ceasing on resting or lying down, and the pyuria is generally intermittent ; whereas in tuberculous kidney blood is usually found only in small quantity, the hæmaturia is unprovoked by exercise and not abated by rest, and purulent urine is continuous, or if it ceases the cessation is the result of occlusion of the ureter. Sometimes there is considerable induration and thickening about the ureter ; and if the patient is thin and has lax abdominal parietes this condition may give rise to the impression that a calculus is impacted in the ureter. I have known this error made ; and even at a post-mortem examination with the peritoneum alone intervening between the indurated ureter and the finger the impression may be maintained till dissection shows the real state of things to be tuberculous, and not calculous at all. Nor is a palpable renal tumour sufficiently common in tuberculous disease for its absence to influence the diagnosis. Still, the kidney is sometimes so enlarged as to cause a tumour which in all respects resembles a nephrectasis due to calculus or any other obstruction. In the early stages before it becomes purulent the urine may be albuminous ; but this is indicative of nephritis rather than of tuberculosis. In renal calculus the urine is often charged with uric acid and urates, in tuberculosis with little masses of caseous material and little phosphatic lumps.

In all doubtful cases the urine should be carefully examined for tubercle bacilli, and if these are found the diagnosis is facilitated. Unfortunately, however, the bacilli are much more difficult to find in urine than in sputum, and therefore a negative result even after a large number of specimens have been examined has not so much significance in regard to the former as to the latter. But if systematic and careful examinations of the urine are made many cases can be definitely settled as being tuberculous in nature which must otherwise have continued doubtful. As previously stated, care must be taken not to confuse the tubercle bacillus with the smegma bacillus, which it closely resembles in its appearances and staining properties. The inoculation of several guinea-pigs with the sediment of the centrifugalised fresh urine is a test which should always be resorted to in doubtful cases. When the bladder is inflamed, as it so frequently is, the urine is ammoniacal and ropy and as this condition of urine is known not to occur in simple renal tuberculosis it often misleads the practitioner into regarding a case as one of simple cystitis, when it is really one of tuberculous disease of the kidney with the addition of cystitis.

In renal calculous affections descending ureteritis and periureteritis are much less likely to reach so low down along the tube as they are in tuberculous disease, and therefore a thickened, nodulated, and indurated ureter below the brim of the bony pelvis, as felt *per vaginam* or *per rectum*, is much more indicative of renal tuberculosis than of a renal calculous disorder.

In the male, tuberculous disease of the kidney is frequently associated with the same disease in other parts of the genitourinary tract; so that an examination of the testes, the prostate, and the vesiculæ seminales should be made, and if either of them be found to be nodular or irregularly indurated additional weight will be thereby given to the diagnosis of tuberculous kidney.

From *renal new growths* tuberculous kidney differs commonly by the hæmaturia being far less abundant, by the persistent pyuria, by the family history and personal antecedent history, by the discovery of the bacilli in the urine, and possibly by the presence of co-existing tuberculous lesions elsewhere in the body. The occurrence of a high temperature with other symptoms would be in favour of tuberculosis, though it should be borne in mind

that a slight elevation of one degree is quite consistent with rapidly growing neoplasm.

In renal new growth, in renal calculus, in movable kidney, and in suppurative pyelo-nephritis and pyo-nephrosis, as well as in renal tuberculosis, there may equally be present a tumour or fulness in the renal region, tender on pressure and accompanied by local and radiating pain ; together with reflex bladder irritation, nephritic colic, and pyuria, and hæmaturia in acid urine.   The differences between the symptoms in these different disorders mentioned have been described under the symptomatology of these several subjects, and need not be here repeated.

As to which kidney is affected.—The diagnosis as to the tuberculous nature of the disease being settled, there may yet be doubt as to which kidney is the seat of the affection, or as to the condition of the opposite kidney if one of the organs is known to be affected.   The presence of a tumour and of pain in one loin and not in the other goes far to settle the question as to the side, and if there is intermittent pyuria with increase in dulness, pain, or tumour when the pus ceases to be present in the urine, there is not only a further indication of the organ involved but good proof that the other organ is not affected.   If the kidney supposed to be healthy is not enlarged and has never been the seat of pain, and if a good quantity of healthy urine is voided at times when there is reason to think from colic and lumbar enlargement that the ureter of the affected organ is blocked, the indications are sufficiently clear that the second organ is sound.   It must not be forgotten, however, that the normal kidney, especially in women during the catamenial periods, may be enlarged and even painful owing to temporary congestion, and also that a healthy kidney may be hypertrophied ; and these facts must be taken into consideration in judging of the state of the second kidney.   Methylene blue, as recommended by Castaigne and Achard, may be of use by proving one kidney to be healthy if the blue appears without undue delay in the urine.   The cystoscope and the ureteral catheter should be employed with reserve and with great caution in tuberculous disease.

There are sometimes seen on the mucous membrane of the bladder in persons with tuberculous renal disease, one or many hyperæmic patches which are apt to be ascribed to disease

in the bladder itself. Tilden Brown has pointed out that after nephrectomy these patches disappear with the vesical troubles with which they are associated, and therefore that they are not the sites in which tubercle develops. I have elsewhere referred to other mistakes in diagnosis which are liable to be made with the cystoscope (*see* Vol. II., p. 323 *et seq.*).

With the ureteral catheter the urine from the two kidneys can be collected separately and examined for the bacilli. From what is known of the uncertainty and difficulty of finding the bacilli in any given specimen of urine, this form of catheterisation may have to be repeated many times before it affords the desired information. If employed at all in this disease the ureteral catheter ought not to be passed into a healthy ureter without having previously well irrigated the bladder with antiseptic solution. Even then there is the risk of urine coming into the bladder from the affected organ and passing upwards along the side of the catheter in the sound ureter. If the bladder be healthy and one kidney is known to be affected, Albarran advises that the ureter of the affected organ should be catheterised with a catheter which exactly fills the ureteral opening, and the urine from it collected whilst the urine from the doubtful organ is allowed to collect in the bladder. To avoid error in the result of this procedure Albarran injects an antiseptic fluid through the ureteral catheter when the catheter is in position, and at the same time watches through the cystoscope to see if any of the fluid passes back into the bladder along the outside of the catheter. If the bladder is itself the seat of tuberculous disease, the ureters ought on no account to be catheterised even after the bladder has been well irrigated.

Prognosis.—Unless the disease is strictly localised, and as such is diagnosed early enough to be radically removed, the prognosis is most unfavourable. This is especially so when both kidneys, or one kidney with its ureter and an extensive tract of the bladder, are involved.

The course of the infiltrating caseous form of renal tuberculosis (as distinct from the acute miliary disease) is much more chronic than is often supposed. The disease progresses often by fits and starts, periods of activity being succeeded by long periods when it is comparatively or entirely quiescent. It is by no means unusual for the disease to extend over four or

five years; its duration in fact varies much, from a few months to several years. Its course is hastened by the supervention of secondary pyogenic infection; and occasionally, though very rarely, by profuse hæmaturia. Reference has been previously made to certain rare hæmorrhagic cases in which the patients have rapidly become anæmic, and a fatal result even has been threatened, by excessive hæmaturia.

The complication of suppurative pyelo-nephritis is one of the gravest significance.

It is not impossible, but it is rare, for this disease to subside, either by the tuberculous material undergoing cretification or by the whole kidney atrophying owing to the complete occlusion of the ureter. Neither prognosis nor treatment, however, ought to be influenced by these improbable events.

Certain well-marked cases of renal tuberculosis have been temporarily or permanently benefited, and some actually cured, by change of residence, a suitable climate, and under a suitable hygienic and dietetic *régime*. Good results of this sort are much more likely to be accomplished in the rich and well-to-do classes, by whom these advantages can be obtained to the full, than in the poorer classes of patients.

The prognosis of surgical treatment has greatly improved with operative experience during the last fifteen years. The mortality after nephrectomy has been reduced from 40 per cent. when Gross published his statistics in 1885, and 38·18 according to Palet's and to Vigneron's figures in 1891 and 1893 respectively, to 18 per cent. as recorded by Israel in 1896 and 7 per cent. by Tilden Brown in 1898.

The following are Vigneron's figures in detail :—

Vigneron* collected 104 cases of nephrectomy for renal tuberculosis which gave a general mortality of 38·40 per cent. and an operative mortality of 29·80 per cent.

They were divided into the following groups :—

(i.) Primary lumbar nephrectomies; 65 cases yielded a general mortality of 40 per cent. and an operative mortality of 29 per cent.

(ii.) Secondary nephrectomies, 20 cases; general mortality, 35 per cent.; operative mortality, 25 per cent.

(iii.) Primary abdominal nephrectomies, 19 cases; general mortality, 36·84 per cent.; operative mortality, 36·84 per cent.

* *Gazette des Hôpitaux*, June 24, 1893.

Tuffier* gives the following results of 16 cases :—

Nephrotomies, 7 cases $\left\{\begin{array}{l}\text{Operative mortality, 2.}\\\text{Amelioration with fistula, 3.}\\\text{Cure, 2.}\end{array}\right.$

Nephrectomies, 9 cases $\left\{\begin{array}{l}\text{Primary, 7 cases}\left\{\begin{array}{l}\text{Total nephrectomies,}\\\quad\text{6 cured.}\\\text{Partial nephrectomy,}\\\quad\text{1 cured.}\end{array}\right.\\\text{Secondary, 2 cases cured.}\end{array}\right.$

With regard to the ultimate result of these cases, Tuffier was able to state that three were in good health for varying periods after the operations, one six years and a half (nephrectomy), another five years and a half (nephrectomy), and the third five years (nephrotomy). The others had finally been lost sight of, but one nephrotomy case was known to have been well two years, and another fifteen months after the operation ; two others (nephrectomies) were well nine and six months respectively after the operation, while two others upon whom nephrectomy had been performed had been too recently operated upon at the time of writing to be able to judge of the final result.

The following analysis of all my operations, thirty-seven in number, for tuberculous disease of the kidney, between February 1888 and the end of the year 1899, shows the nature and result of the operation in each case :—

Of eighteen total *nephrectomies* thirteen recovered and five died.

Of the five fatal cases, in one the opposite kidney was found on post-mortem examination to be fatty and the spleen and intestines lardaceous ; in a second the patient died soon after the operation from general tuberculosis ; and in a third in which the disease of the kidney had set up a perinephric abscess which was the immediate cause of operative treatment, the opposite kidney was found after death to be tuberculous. In the other two cases death was due to causes independent altogether of the operation : in one case to broncho-pneumonia and emphysema, and in the other to perforation of a gastric ulcer. Of the thirteen cases which recovered from the operation, two died shortly afterwards : death ensued in one case seven weeks after the operation owing to advanced cystic degeneration of the opposite kidney,

* *Traité de Chirurgie;* Duplay and Reclus, 2nd ed. (1899), tome vii., p. 304.

and in another from convulsions one month after the operation, the opposite kidney being found on post-mortem examination in an advanced state of hydro-nephrosis. A third recovered from a subcapsular nephrectomy, but the capsule became distended with blood-stained serum and formed a large abdominal tumour which was subsequently successfully removed. A fourth died four months after the nephrectomy from tuberculous disease of the lungs. The other cases recovered, and most of them have since been heard of as remaining well. Some of them were known to be well several years afterwards.

In seven cases *partial nephrectomy* was performed, but in three of them total nephrectomy had subsequently to follow. The other four patients were known to be well at considerable periods after the operations. One of them was heard of in March, 1898, three years and three months after the operation, and is believed to be still quite well. Another was known to be well in September, 1896, four and a half years after the operation. Another whose opposite kidney had been explored by another surgeon (a fistula being left) was alive in 1896, two and a half years after the operation. The fourth case had previously had one kidney removed in Canada, and I subsequently excised about one-third of the remaining kidney. She is still alive and actively engaged in domestic service, now nearly four years after the partial nephrectomy.*

In one case just referred to the renal capsule and the ureter down to the broad ligament were removed several weeks after subcapsular nephrectomy had been performed. The patient made an excellent recovery and was known to be well some months later.†

In four cases *nephro-ureterectomy* was the operation. One of the operations followed a partial nephrectomy; the patient recovered from the operation, but died five weeks afterwards from hæmoptysis and tuberculosis of the lungs and peritoneum.

The other three patients made good recoveries, and were known to be well many months later: one has been lately heard of as well, now three years and a month after the operation.

In seven patients the operation was *nephrotomy*. Of these one died from disease of the opposite kidney soon after being

* December 11th, 1900: This patient was seen to-day in very good health. She is now earning her living as a working housekeeper.

† See *Lancet*, January 1st, 1898, p. 19.

operated upon ; two recovered from the operation but died soon after from tuberculosis of other organs; in two others nephrectomy was subsequently performed ; and in the remaining two the wounds healed well, and in one of them the opposite kidney was afterwards operated upon.

The remote results of nephrectomy and of partial nephrectomy are in a large majority of cases excellent ; patients are known to be alive and in good health three, five, and eight years or more after undergoing the operation.

The commonest cause of death is asthenia due to the gradual progress of the disease and to the exhaustion and cachexia consequent upon the discharges, upon the frequent painful micturition and loss of sleep, and upon fever, anorexia, and diarrhœa. Septicæmia is an occasional result of suppurative changes in a kidney the ureter or renal pelvis of which is occluded so that the natural channel no longer affords a means of escape for the septic matters. When only one kidney is present, or when both kidneys are diseased, anuria and uræmia are causes of death.

A fact which should not be overlooked is that not only are the immediate and remote or permanent results of total or complete nephrectomy good when the operation is undertaken in good time, but that when the operation is performed as a tentative measure of relief in very advanced local disease—the patients being in a state of very marked cachexia—some most surprising recoveries have followed.

Treatment.—The treatment of tuberculous kidney should be carried out on the same principles as those which govern the treatment of tuberculosis elsewhere.

The objects to be aimed at are twofold : (1) To keep up the general nutrition of the patient, and (2) to remove the source of infection whenever possible.

To attain the first of these objects the patient should have plenty of fresh air and good nourishing food, and should take maltine, cod-liver oil, and plenty of other fatty articles of diet, such as cream and butter. Creosote gradually increased to 15 or 20 minims three times a day is recommended. If there is much pain relief may be obtained by the application of fomentations and other anodyne preparations to the loin.

Residence in a dry bracing climate, sheltered from cold and damp, and especially in a locality where pine wood abounds, should

be obtained if possible. A sea voyage is often of great benefit; a residence at Arcachon, Sydney, or Colorado is highly advantageous.

The question of surgical treatment has to be carefully considered in each case. If the renal tuberculosis is only a part of an advanced widely spread infection, it is clear that no operation should be undertaken; but if, on the other hand, the disease appears to be localised, at any rate so far as its activity is concerned, then there is a good prospect that an operation may not only relieve the symptoms but even effect a permanent cure.

But, as has already been seen, the disease too often affects both kidneys, and therefore it becomes of the greatest importance to gain knowledge of the condition of the opposite kidney before deciding the nature of the operation; for it would be unwise to perform a nephrectomy if it were certain that the kidney on the opposite side was in an advanced stage of disease. Unfortunately it is in some cases very difficult to ascertain the actual state of the opposite kidney. Careful and systematic examination of the urine should be made in every case, as it sometimes happens that the ureter on the affected side becomes blocked for a time (an event which is usually accompanied by attacks of colic), and the condition of the urine escaping from the opposite ureter may under these circumstances yield very positive information. In some cases, especially in females, the diagnosis may be assisted by a cystoscopic examination or by catheterisation of the ureter, but the restrictions of and precautions for this mode of investigation have just been indicated.

Nephrectomy.—Nephrectomy, partial or complete, is the ideal operation for a tuberculous kidney, since the local infection is thus completely removed; but, unfortunately, the number of cases upon which it can be practised is limited on account of disease of the opposite organ. Nephrectomy alone, however, is very frequently insufficient to effect a complete cure, and it is of the greatest importance to examine the condition of the ureter, which also in a large proportion of cases is diseased. That so many primary nephrectomies for tuberculous disease have in the past been followed by fistulæ is owing to the fact that an infected ureter has been left unremoved. It is not sufficient in such cases to ligature the ureter just below the kidney, but as much of its length as is diseased should if feasible in the particular case be completely taken away. In the male the duct may be

traced down and divided close to the bladder; in the female it can seldom be so completely extirpated, owing to the difficulties of manipulation in the neighbourhood of the broad ligament; but it can always be traced with safety below the brim of the pelvis where it should be severed and ligatured, care being taken that none of its infective contents escape during the process. The cut end should be well scraped and then thoroughly rubbed with an emulsion of iodoform.

The question as to whether a nephrotomy should be first performed, to be followed by secondary nephrectomy in cases suitable to the latter operation, has been much discussed. The advantages that have been claimed for this practice are (1) that the patient, later on, will be better prepared for a severe operation, and (2) that after a nephrotomy the tumour may shrink and make nephrectomy more easy to perform.

With regard to the first of these points, it may be said that, with due precautions, most (not all) of the patients who can bear a nephrotomy can undergo a nephrectomy; and with regard to the second point, experience has shown that the diminution in volume of the kidney, except in some cases of tuberculous pyonephrosis, is not likely to be such as to render a subsequent nephrectomy more easy. In most cases no very appreciable diminution in size really occurs, owing to the number or extent of the caseous infiltrating masses; or if these have broken down, to the loculated nature of the tumour. Moreover, the difficulty and danger of secondary nephrectomy are sometimes made greater than those of primary nephrectomy by the increased toughness and adhesions of the perinephric tissues which follow nephrotomy and drainage.

The surgeon must bear in mind that it is in tuberculous diseases of long standing especially that the probability of the second kidney being diseased is so great; and he must be on his guard against the catastrophe of removing a kidney and losing his patient within a few days from uræmia, and then finding on the post-mortem table that the opposite kidney had likewise been destroyed.

It would appear from the figures mentioned on pp. 484–5, that the chances of such a catastrophe are very much greater in operating upon children with tuberculous kidney than upon adults.

Albarran has pointed out the advisability of cutting into a

tuberculous kidney before removing it, after previously protecting with sponges or swabs the perinephric tissues, because it is often impossible before doing so to tell how much of the disease is due to secondary infection and how much to tubercle, and that by taking this precaution a kidney may sometimes be saved.*

Nephrectomy is required in certain rare and exceptional cases as an operation of emergency. This is so when hæmorrhage is profuse and threatening the life of the patient ; or when severe and frequently recurring attacks of colic confine the patient to bed, and necessitate the administration of large quantities of narcotics or prolonged and repeated inhalations of chloroform ; such attacks may be caused by the passage of masses of *débris* in cases in which abscess cavities and breaking down caseous masses open into the renal pelvis, and in cases of inter-mittent hydro- or pyo-nephrosis from tuberculous ureteritis. The operation may be urgently required, also, when a sudden access of fever and suppuration supervenes upon chronic tuberculosis of the kidney, whether this happens in pyo-nephrosis or abscess formation or diffuse suppuration in connection with caseous foci, and whether the foci or abscesses communicate or not with the renal pelvis.

In the last group of cases, *nephrotomy*, if care be taken to open up all the independent abscesses or vomicæ, may suffice to reduce the fever and the risks of septicæmia, and to remove the other more serious general symptoms caused by the secondary pyogenic infection ; but primary nephrectomy is the operation to choose in these cases, if we know the condition of the other kidney to be good, and if the strength of the patient will allow. If nephrotomy is the operation immediately resorted to in such a case an excellent temporary result may follow ; but secondary nephrectomy will be required, providing the opposite kidney will permit of it, if abundant suppuration continues, if the drainage of the several abscesses or vomicæ is incomplete, if general septic infection threatens, or if a troublesome fistula persists.

The indications for nephrectomy are controlled also, though to a less degree than by the state of the opposite kidney, by the integrity or otherwise of the rest of the genito-urinary organs : thus, as Tilden Brown states, when unusual or very severe symptoms occur in the course of renal tuberculosis— even if there

* *Ann. des Mal. des Org. Genito-urinaires*, 1897, p. 17.

exists in another organ of the patient an appreciable tuberculous deposit, provided it be not in the opposite kidney—immediate nephrectomy is not only legitimate, but is even strongly indicated. Tuffier points out also that, whereas a simple tuberculous nodule in the prostate is not a contra-indication if the patient is suffering from a pyo-nephrosis with severe constitutional symptoms ; yet that, on the contrary, if a similar nodule is formed in a patient affected with chronic renal tuberculosis, without febrile symptoms, one would hesitate before undertaking, and probably should refuse to undertake, an operation.

Concomitant disease of the bladder is an almost insuperable contra-indication. If the vesical disease is quite confined to the area immediately around the ureteral orifice, and if the kidney and ureter of one side only are tuberculous, nephro-ureterectomy, including the removal of the affected piece of the bladder, may be performed in some unique cases. Trendelenburg has successfully performed this operation.

The cases in which nephrectomy is inappropriate or out of the question are those in which the opposite kidney is certainly or probably the seat of tuberculous or of some other advanced or advancing disease, though it may be less extensive than in the kidney upon which operation is contemplated ; cases in which any one of the lower urinary organs, especially the bladder, is the seat of tuberculosis ; those in which the state of the peritoneum is in doubt, or the lungs are extensively affected ; and in the female when the Fallopian tubes or ovaries are tuberculous. But, as stated above, even in some such cases, under conditions not easy to define in general terms, if the principal disease is in the kidney, and is progressing or is not abated by nephrotomy and drainage, nephrectomy may be tried, and its performance is often justified by the marked, even though temporary, improvement which it affords.

The technique of the operation is the same in tuberculosis as in other cases. The lumbar method is the method for choice. The sub-capsular operation is often compulsory in tuberculous cases, and piecemeal removal may be the only thing possible. This mode of operating was very early employed by Lucas, Morrant Baker, and other English surgeons, as the *Transactions* of the International Congress in 1881 and the medical journals show. As the capsule may be itself infiltrated with tubercle its removal with the kidney when possible is decidedly to be preferred ; and

when the renal substance has had to be enucleated from the capsule, as much of the latter as can be separated from its adhesions to the surrounding structures should be trimmed away afterwards.

Partial resection of the kidney is perhaps the operation which gives the most promise for the future, if only operations are undertaken at an early period, and when the disease is limited and localised : for in suitable cases this method possesses the advantages of nephrectomy, inasmuch as the source of infection is completely removed without the risk of being followed by a fatal result should the opposite kidney be defective.   When partial resection is practised the patient is still left with a considerable amount of secreting tissue, which is thus able to counterbalance disease of the opposite kidney, should such be present. As I have mentioned on an earlier page (p. 511), there is a woman living, and leading an active life from whose second kidney four years ago I excised about one-third for tuberculous disease. Her other kidney had been previously removed for the same disease.

Nephrotomy in tuberculous disease ought to be regarded simply as a palliative operation for the relief of symptoms due to pyo-nephrosis ; and it is only otherwise indicated in cases where the patient's condition is too extreme to bear the more severe operation of nephrectomy, or in which the disease is advanced or widespread in other organs, or where the local adhesions are so great that no attempt at nephrectomy is desirable.

Nephrotomy, although inferior in its curative results to nephrectomy, is nevertheless very useful in cases where free drainage can be obtained and where the more radical operation cannot be performed.

When the disease is not far spread it may be checked altogether by giving a free and direct means of escape for the pus of a solitary abscess. The relief which has sometimes followed an incision of the kidney in search for a stone, in cases in which no stone has been found, is to be explained in this way.   The unsatisfactory points with regard to nephrotomy in cases of abscess, in addition to the very important fact that foci of the disease are apt to be left behind in the kidney, are the danger of infecting the wound by the discharge, and the difficulty in many cases of securing free drainage for multiple abscesses without which a cure cannot be attained.

To cut into one of several abscess spaces and to drain it,

leaving others unopened and unable to discharge their contents,
is unsurgical in theory and unsuccessful in practice. It is true
that after the evacuation of one abscess others do sometimes
partly empty themselves through the wound into the renal pelvis;
but this mode of relief is uncertain and, usually, insufficient,
and it is far better in such a case to remove the kidney at once.
I have opened and scraped out as many as seven tuberculous
abscesses in the same kidney, with the best possible immediate
and remote results : the man was alive and well several years
afterwards.

Summary as to surgical treatment.—No strict rules can
be laid down with regard to the adoption of any particular
operation in the treatment of tuberculous kidneys, for while each
has its special applications, the best results will be obtained by
a judicious selection in individual cases. The whole kidney must be
carefully examined, close search must be made for separate caseous
deposits, for scattered miliary tubercles, and for independent ab-
scesses and vomicæ. The condition of the ureter also must be
ascertained.

By a careful exploration it may be discovered that
what at first sight seemed to require complete nephrectomy
may be successfully treated by partial nephrectomy; or what
is much more probable is that an intended nephrotomy must
be changed for a nephrectomy or a nephrectomy for a nephro-
ureterectomy, owing to the occlusion or very advanced state
of disease of the ureter. To obtain a complete cure, partial
resection and nephrectomy are both far in front of nephro-
tomy, but their application is necessarily limited; and it is
just in those cases where the more radical operations cannot
be carried out successfully that the wisdom of choosing nephro-
tomy is shown ; for where from disease of the opposite kidney
or other reasons nephrectomy would probably be followed rapidly
by a fatal result, nephrotomy may greatly relieve the symptoms
and prolong life, although a permanent cure cannot be expected.

CHAPTER XVII.

RENAL SYPHILIS.

THE occurrence of syphilitic affections of the kidney was first pointed out by Rayer in 1840, but the condition had not received much attention till within the last few years, and indeed the albuminuria and acute forms of nephritis which occur during the secondary stage of syphilis were until recently thought by many to be the effects of the mercurial treatment.

Syphilitic affections of the kidney may be divided into three classes, according to whether (1) they occur during the early or secondary stage, or (2) during the late stage, or (3) are associated with the congenital type of the disease.

During the secondary period of syphilis it is not uncommon to find some albumen in the urine and more rarely there may be a definite nephritis. The albuminuria is generally transient, and appears about the same time as the secondary rash ; it is not usually accompanied by any definite symptoms, and is doubtless very frequently overlooked.

Less commonly, a definite acute nephritis occurs, which runs the clinical course of acute nephritis due to other causes, and terminates in resolution or in the chronic tubular nephritis which gives rise to the large white kidney. Microscopically, the secreting structures are the parts chiefly affected, and in some instances the appearances closely resemble those found in the kidneys from cases of scarlet fever.

The symptoms of these acute cases are similar to those accompanying Bright's disease from other causes, and have nothing specific in their character. They may run an acute course terminating in uræmia, but frequently the symptoms are intermittent with well-defined intervals, and the albumen often persists long after all other symptoms have disappeared.

Although the exact causal relation between nephritis and the early stage of syphilis is somewhat obscure, it is now established beyond doubt that some definite relationship does exist, for careful observations have shown that the cases cannot be explained as mere

coincidences of nephritis occurring during the course of syphilis. Neither is the exact cause of the condition known : it may be due to the presence of a micro-organism or a toxine, or it may be due to a congestion similar to that which occurs in the skin and mucous membranes during the secondary stage of the disease.

Typical cases have been recorded by Mauriac,* Hudelo,† Fordyce,‡ and many others ; but the frequency with which the condition occurs cannot be said to be accurately determined. Mauriac collected twenty-three cases, in eight of which the symptoms appeared two months after the chancre. Harrison states that albuminuria occurs in from 3 to 8 per cent. of secondary syphilides ; and Petersen § places it at about 3·8 per cent. Furbringer ‖ found albumen and casts during the roseola stage in twelve cases out of a hundred. As already stated, the nephritis of early syphilis attacks the secreting structures, and microscopically the lesions are seen to affect chiefly the parenchymatous tissue. The epithelial cells are swollen, granular, and in some instances detached and undergoing fatty changes, while the interstitial tissue suffers but little in proportion. There is nothing specific in the onset, course, or post-mortem appearances of these cases. The diagnosis rests only on the relationship between the two diseases, and therefore great care must be taken in every individual case to exclude all other possible causes of the nephritis before its direct dependence upon syphilis is accepted as the fact.

It is probable that the careful and moderate use of mercury does not produce albuminuria ; on the other hand, many patients appear to derive direct benefit from anti-syphilitic treatment. The prognosis in these cases is difficult, but a large amount of albumen, the presence of epithelial and fatty casts, and the onset of respiratory or other complications are grave signs.

Renal disease appears on the whole to be considerably more common during the later stages of syphilis than in the earlier ones. The interstitial and amyloid forms are most frequent during the late period, but occasionally the parenchymatous variety occurs,

* *Archives Gen. de Méd.*, Oct., Nov., and Dec., 1886.
† *Semaine Med.*, 1893, p. 358.
‡ *Journ. Cut. and Gen.-urin. Disease*, April, 1897.
§ *Brit. Med. Journ.*, Oct. 3rd, 1891.
‖ Quoted in " Manuel de Médicine," by Debove and Achard.

as also do mixed varieties, so that beyond stating that the interstitial forms predominate nothing more definite can be asserted.

In forty-nine cases of late renal syphilis, Bamberger found four cases of acute nephritis, twenty-nine of chronic parenchymatous nephritis with large white kidneys, and sixteen of the chronic atrophic variety.

In sixty-three cases, examined microscopically by Wagner, there were eight acute cases, four chronic parenchymatous cases, and eight small granular kidneys; in the other cases atrophy was limited to one kidney alone, while the opposite organ was either hypertrophied or normal.

Sometimes the interstitial change is localised without forming definite gummata; thus M. Key* found sclerosis of the inferior parts of both kidneys associated with gummata of the heart and hypertrophy and dilatation of the ventricles.

The kidneys in which interstitial changes are present are usually considerably diminished in size, and are often irregular in shape, with scars on their surfaces.

Lancereaux, in twenty observations on cases of visceral syphilis, found an interstitial nephritis present in four, waxy degeneration in two, and small gummata in one, while several other kidneys showed some amount of scarring and atrophy. Microscopically, the interstitial tissue is found to be greatly increased and the walls of the arterioles are thickened; the tubules are affected secondarily, many are obliterated, and there is fatty and granular degeneration of their epithelial cells.

Though gummata of the kidney are admittedly rare, they are recorded by Lancereaux, Klebs, Moxon, Greenfield and others. In Moxon's case the gumma was the size of a small potato, firm, hard, tough and of a yellowish colour. Morell Mackenzie also recorded a case of gummata in the liver and right kidney in which the renal capsules were adherent. Gummata usually exist as small deposits either in the cortex or medullary region, and they vary very much in number and size. There are often several not much larger than a pin's head, while at other times the presence of one or two may give rise to a considerable swelling and cause the same general symptoms as renal tumours of other kinds. Thus Legrain † has recorded a case of hereditary

* Quoted by Mauriac.
† *Annales des Malad. des Organes Gén.-urinaire*, 1898, p. 1155.

syphilis, in which a painful varicocele was a prominent symptom, a fact of importance since this effect is most commonly produced by malignant tumours. Gummata occur in the interstitial tissue between the tubules and the glomeruli; they are of a yellowish colour, and often show some softening and tendency to break down in the centre; this tendency to undergo softening is not, however, nearly so great as in the case of tubercular deposits, and Baumgarten has compared their consistency to bacon, in contradistinction to the yellow caseous necrotic deposits which occur in tuberculosis. Their histological characters are the same as those of gummata elsewhere.

Gummata, if not very numerous, may not of themselves give rise to any alteration in the urine, nor need they cause any symptoms; but their presence is frequently accompanied by some diffuse interstitial changes upon which the general and local symptoms often depend.

They not unfrequently disappear, and their previous existence is then betrayed by a scar which if near the surface may cause a very considerable depression of the renal substance.

The chief surgical interest with regard to gummata lies in the fact that they sometimes cause such gross changes in the kidney that they are mistaken during life for malignant or tuberculous disease, and on that supposition have been operated upon.

An interesting case of this description has been recorded by Bowlby.* The patient, a female aged forty, noticed a swelling in the right renal region, and on examination it was found that the right kidney was movable, unusually hard, and a little enlarged; the urine was normal except for a trace of albumen. A year later the tumour had increased in size, and formed a definite renal tumour which was exceedingly hard and easily movable. The urine still contained a trace of albumen, but there was no hæmaturia at any time during the illness. There was a history of syphilis having occurred twenty-one years previously.

Nephrectomy was advised and duly performed, the kidney being easily shelled out of its capsule. The whole organ was very enlarged and exceedingly hard: it weighed seventeen ounces. The surface was nodular, and there was no dilatation of the calyces or pelvis. It cut like fibrous tissue, and on section showed areas of wash-leather-like gummatous masses embedded in dark-coloured fibrous

* *Trans. Path. Soc.*, 1897, p. 128.

tissue. All trace of cortex and pyramids had disappeared and, except for its shape, the mass of tissue bore but little resemblance to a kidney. Microscopical examination showed typical gumma- tous areas, with small-celled infiltration and caseous degeneration, much new fibrous tissue, and very scanty remains of secreting structure.

Israel* has also recorded two interesting cases of a similar nature, which led to a mistaken diagnosis.

The first case was that of a woman, aged twenty-three, who suffered from frequency of micturition, thirst, and pain in the back. There was also considerable loss of flesh. An examination showed the right kidney to be much enlarged and hard, but not especially tender ; it was not movable, and did not descend during inspiration. The urine sometimes contained a small quantity of albumen, and microscopically renal epithelium and pus cells were present, and on one occasion a hyaline cast was observed. A careful consideration of all the symptoms taken in con- junction with the past history of the patient led to the true nature of the condition being suspected, and the patient was placed upon anti-syphilitic treatment. This was for a time followed by improvement and some decrease in the size of the tumour, but collections of masses of flattened cells appeared in the urine as a white deposit, and it was thought advisable to explore the kidney under the idea that the tumour might be of a malignant nature. This operation was accordingly per- formed and the kidney, which was greatly altered, was removed. The renal capsule was much thickened and very nodular, espe- cially on the outer surface, and was very firmly adherent to the kidney substance. The kidney itself, which was not much en- larged after the capsule was removed, was chiefly affected in its lower half, and was the seat of gummatous infiltration.

The second case occurred in a man of thirty-nine, and was mistaken for tuberculous disease. There was a tuberculous family history, and also a history of syphilis. The percussion note was diminished under the right clavicle and there was a scar with a fistulous opening between the eleventh and twelfth ribs on the left side. The urine contained albumen and pus, but no tubercle bacilli were found. Exploration, followed by nephrec- tomy, was performed ; the kidney was separated from its adhesions

* *Deutsch. Med. Woch.*, 1892, No. 1.

with some difficulty, and was found to be the seat of extensive fibrous degeneration and gummatous swellings, in parts undergoing caseation.

Kelynack in his work on " Renal Growths," mentions and figures a case of diffuse fibroid induration of the kidney which at first sight resembled a diffuse malignant growth ; it proved, however, on closer examination to be an example of

Fig. 74.—Gumma of Kidney.   (St. Bartholomew's Hospital Museum, 2343 A.)

diffuse syphilitic cirrhosis, and a somewhat similar gummatous mass was also found in the liver.

The following case, illustrated in Fig. 75, occurred under my own care. The patient, a man aged sixty-four, came to me on account of persistent hæmaturia and frequent micturition of fifteen months' duration. The micturition occurred about every hour and was attended with very great pain and spasm. An examination showed the presence of a growth in the bladder which proved to be a villous carcinoma with a hard infiltrating base extending from above the left ureteral orifice up to the fundus. Supra-pubic cystotomy was performed on October 25th, 1898, and the bladder drained through a tube.   The operation gave great relief, the patient slept well, the urine became clearer, and about twenty ounces drained off every twelve hours. Some diarrhœa, unattended by sickness, had existed before the operation and con-

tinued after it.   The improvement continued till October 30th, when the patient became restless and disinclined to take nourishment, and this together with diarrhœa and vomiting which supervened made him very weak ; his pulse was regular and of fair tension and there was a free flow of urine.   The next day there was some improvement, which continued till November 5th, when he again became very restless and sleepless and attempted to get out of bed.   From this time onward the condition got rapidly worse and hallucinations and delusions were a marked feature ; he was very violent in his delirium and resisted furiously the changing of his dressings.   The quantity of urine diminished, but it became very difficult to measure it.   The restlessness and incoherence increased, but were relieved by hyoscin ; the skin was quite dry and there was still diarrhœa.   During the last few days of the illness there were marked muscular twitchings, and the pupils reacted sluggishly to light.   After the delirium had been relieved by the hyoscin the patient became drowsy, but was easily roused by turning up the light or calling loudly.   He turned rest-

Fig. 75.—Syphilitic left Kidney.   Author's case.   (Middlesex Hospital Museum.)

lessly in his bed from time to time, every now and again mumbling in an incoherent manner.   He resisted feebly when the dressings were changed and would take no food, appearing to have some difficulty in swallowing.   Respirations were regular and the highest temperature registered was 99·6 ; it was often subnormal. The breath had a peculiar odour which could not definitely be described as urinous.   The urine still gradually diminished in quantity and the patient died on November 13th.

At the autopsy made by Dr. Voelcker no growth was found in any other organ but the bladder, but there was extensive dis-

ease of the kidneys. Both kidneys were very firm and enlarged,
measuring 4½ inches in length ; their surfaces were pale yellowish
grey speckled with red, and were markedly irregular on account
of numerous depressions of various sizes ; their capsules stripped
with difficulty.   On section they presented a greyish-yellow ap-
pearance in the cortical region, which was increased in thickness,
measuring over a quarter of an inch. The medullary portion
was congested and showed uratic deposits in some of the straight
tubules. Sections stained with iodine and methyl violet showed
very marked waxy disease of the glomeruli, of the vasa recta, and
of the walls of the straight tubules.   There was also some fatty
degeneration of the renal epithelium and overgrowth of interstitial
fibrous tissue. There was no dilatation of the renal pelves and
no pyelitis ; the ureters were not dilated and there was no
evidence of any ascending uretero-pyelo-nephritis.   There was
no focus of suppuration anywhere in the body (except a small
recent superficial abscess in the abdominal wall) and there was
no evidence of any suppuration having existed at a former time.

The liver was rather large, pale and very firm, with rounded
edges.   Numerous irregular puckered scars were present in the
right lobe ; the left lobe was small and puckered.   The depressed
scars corresponded to areas of cicatricial tissue and were evidently
old gummata. The spleen was much enlarged, measuring seven
inches in length ; it was dark, firm and smooth on the surface,
showing no scars ; on section the surface was dark red, smooth
and glistening.   Sections of both liver and spleen showed marked
waxy disease on staining with iodine and methyl violet.

The actual cause of death must be ascribed to the advanced
renal disease, which was undoubtedly of specific origin, and the
case therefore is especially interesting on account of the clinical
symptoms associated with it.   The later stages of this case, which
depended upon the renal disease, bore some superficial resemblance
to anuria from calculus or obstruction to the ureters by pelvic
cancer, and had the patient been seen for the first time in this
later stage these possibilities might have entered into the question
of diagnosis.   The symptoms, however, in reality differed very
materially from those of anuria in the following points : (1)
The presence of violent delirium and (2) continued wakefulness ;
(3) there was no urinary obstruction, but a gradual increasing
suppression without any interference in the flow ; (4) there

was no lumbar pain whatever ; (5) the skin was dry, with entire absence of sweating ; (6) diarrhœa was present and persistent to the end ; (7) there was great increase of pulse tension which only gradually failed during the last few days of life.

Albuminoid degeneration is not unfrequently a late effect of syphilis, and may co-exist with the other forms of the disease. The possibility of its presence must be remembered as a factor in renal diagnosis, and its influence must also be taken into account when considering the advisability and prognosis of operations ; but for a detailed account of its symptoms the reader is referred to works on medicine.

Diabetes mellitus and insipidus have occasionally been recorded in syphilis, but their origin in such cases usually depends upon the effects of gummata in the central nervous system and not to any direct action of syphilis on the kidneys.

The kidneys may occasionally suffer from the effects of congenital syphilis, which usually shows itself by an increase of interstitial tissue. A case of this kind has been recorded by Coupland in a female child of three months. There were very extensive syphilitic manifestations in the viscera, including gummata of the liver and lungs. The kidneys to the naked eye appeared pale and unduly firm. Microscopically, the cortical region was the seat of an interstitial infiltration of small round cells which were most abundant round the arterioles and especially round the Malpighian bodies. The renal epithelium was unaltered.

Diagnosis.—The diagnosis of renal syphilis is difficult and often cannot be made with any certainty, since the symptoms do not present any specific qualities. Difficult even in those cases which arise in the early stages of syphilis, it becomes far more so in the later stages when no direct relations between the disease and its effects can be traced.

The diagnosis of acute syphilitic nephritis occurring in the early stage of the disease can only be made after all other possible causes have been rigorously excluded, and therefore each case must be considered on its own merits ; in some the relations appear fairly obvious, while in others they are very obscure. In the nephritis of late syphilis, which generally assumes the chronic interstitial or gummatous form, a diagnosis will depend upon a definite history of syphilis and the presence of tertiary symptoms elsewhere, other causes being excluded. The diagnosis is

sometimes further strengthened by improvement under anti-syphilitic treatment. The difficulty of placing syphilis as the definite cause of these chronic cases is further intensified by the fact that in many instances other possible causes cannot be absolutely excluded ; and many mixed cases occur as, for instance, chronic alcoholism following a previous history of syphilis. If the kidney is much enlarged it cannot with certainty be diagnosed from other tumours unless the evidence of co-existing lesions elsewhere is exceptionally strong. The cases recorded above show that renal syphilis is very liable to be mistaken for malignant disease.

Treatment.—The treatment of the different forms of syphilitic nephritis must be carried out on the general principles which govern the treatment of nephritis due to other causes. The occurrence of albuminuria and even the more definite forms of nephritis during the early stages of syphilis are not usually contra-indications to the administration of mercury provided its effects are carefully noted, for it must be remembered that the diseased kidneys cannot eliminate the drug as they do in health. In some cases mercury appears to have a direct beneficial action, the renal symptoms subsiding rapidly under its influence. In the cases arising during the late periods potassium iodide may be given, especially if the presence of gummata is suspected, but in most of these cases the connective tissue changes are so advanced before symptoms arise that but little benefit can be expected from medicinal treatment.

CHAPTER XVIII.

TUMOURS OF THE KIDNEY.

THE kidney is liable to many morbid growths of a cystic and solid character, both benign and malignant. Several of these do not attain to any great size, or cause the kidney to become appreciably, if at all, enlarged. Thus *adenoma*, which occurs in three forms in the kidney (the tubular, the papillary and the alveolar), is usually the size of a hazel-nut or walnut, but seldom if ever as large as an egg or small orange; *angeiomata cavernosa*, though distinct formations or new growths of reticulated cavernous tissue, are of quite small size not often exceeding that of a marble, and though called tumours the parts which they affect are shrunken, rather than projecting or enlarged; *leukhœmic tumours* are small, scattered, roundish patches of lymphoid cells following the course of the capillary vessels, and looking not unlike extravasated white blood cells, though they are sometimes actively growing tumours of a truly malignant character; *lymphadenoma* is found in the kidney associated with similar disease of the glands, liver, and intestine; *fibroma* occurs " in the form of small white knots of fibrous tissue near the bases of the pyramids," * but occasionally in the kidney there has been found a very large simple fibrous tumour; tumours consisting of *fatty tissue* or of a mixture of *fatty tissue and unstriped muscular fibres* are small growths, single or multiple, which rarely surpass the size of a cherry. True lipomata, the heteroplastic lipomata of Virchow, are found sometimes in the cortical substance immediately beneath the capsule. *Villous papilloma* occurs in the pelvis of the kidney, as it does in the urinary bladder, and in a case met with in the post-mortem room of the Middlesex Hospital, there were villous growths in the kidney † and bladder of the same person. *Syphilitic gummata* occur occasionally, but do not often attain such a bulk as greatly to increase the

* Moxon.

† There is also a specimen in the Middlesex Hospital Museum (*see* Catalogue, No. 1822).

dimensions of the kidney. *Cysts* varying in size and number occur, as for example in granular kidney, without adding to the size of the organ.

Though pathologically of the nature of "tumours," some of the above-mentioned new formations never, others only rarely, give rise to tumours clinically speaking.

Clinically, any enlargement of the kidney which can be detected by physical examination at the bedside is spoken of as a tumour of the kidney. Some of these enlargements have been already considered; namely, hydro-nephrosis, pyo-nephrosis, renal abscess, and the enlargement of the kidney caused by *tuberculous* disease. There remain for description, however, other renal tumours, cystic and solid; amongst the solid are carcinoma, sarcoma, and rhabdo-myoma, all of the nature of malignant new growths; and amongst the cystic are various forms—serous, polycystic, dermoid, and hydatid.

Some idea of the relative frequency with which the different tumours occur may be gathered from the following table of 159 cases which I collected from British, American and foreign literature during a period of ten years from 1884 to 1893 inclusive.

Sarcomata	63
Carcinomata	41
Cystic degeneration . . .	21
Hydatid cysts	11
Adenomata	10
Papillomata	3
Myxomata	2
Lipomata	2
Dermoid cyst	1
	154

Of the remaining five cases, in one the tumour was due to a collection of cholesterine, one was of doubtful nature, and the other three were tumours of the suprarenal body.

The following are the ages at which the tumours occurred in 148 of the cases:—

Under 5 years,	5–10,	10–20,	20–30,	30–40,	40–50,	50–60,	60–70,	70–80
39	2	6	14	20	30	22	11	4

Of the 39 cases occurring under 5 years of age, there were 31 sarcomata, 2 carcinomata, 1 cystic degeneration, 1 fibro-cystic tumour, 1 rhabdo-myo-sarcoma, while two were tumours of the adrenal and one was of doubtful nature.

Renal tumours are amongst the most difficult of abdominal enlargements to diagnose correctly. They therefore demand close study, and it will save repetition if I make some general remarks on the clinical characters of these tumours as a class. By way of preface, I will draw the reader's notice to a passage from Spencer Wells's paper "On the Diagnosis of Renal from Ovarian Cysts and Tumours."* That brilliant ovariotomist wrote, "I quote the following remark of one of the greatest clinical teachers of any age or country—Bright : 'I have known the enlarged kidney to be mistaken for disease of the spleen, of the ovary, of the uterus, and for a tumour developed in the concave part of the liver ; nor is it perhaps possible, by the greatest care and the most precise knowledge, altogether to avoid such errors.'"

The chief **distinctive points** about tumours of the kidney are the following :—

1. The large intestine is in front of the tumour. Normally the right kidney, unless enlarged, lies a little way from the lateral wall of the abdomen, behind and to the inner side of the ascending colon ; not in close contact with the abdominal wall and outside the ascending colon as the liver does. When the kidney is enlarged the ascending colon is usually placed in front of and towards the inner side of the tumour. On the left side, the descending colon is in front of, and inclines towards the outer side of, the kidney below ; in some cases coils of small intestine may overlie either right or left tumour if the enlargement is not sufficient to bring the kidney into direct contact with the front abdominal wall. When the colon is empty, or non-resonant, it can be felt as a roll on the front surface of the tumour. Clifford Allbutt in a private letter referred to this last statement and said that he was able to confirm it by a case then under his observation. These relations of the small intestines and the colon to a renal tumour are met with in the child as well as in the adult. Fagge described and illustrated them in the case of a carcinomatous tumour weighing four and a half pounds which affected the left kidney of a child aged four and a half years.†

Bowel is never thus placed in front of a splenic tumour, and only very occasionally in front of one of hepatic origin.

* *Dublin Quarterly Journ. of Med. Science*, Feb. to May, 1867.
† *Path. Soc. Trans.*, vol. xxi. p. 250.

If ascites is present and the liver is enlarged in an irregular and misshapen manner the small intestines may float between the liver and the abdominal parietes.

2. There is no line of resonance between the kidney dulness and the vertebral spines ; and no space between the kidney and the spinal groove into which the fingers can be dipped with but little resistance, as there is between the spleen and the spine.

3. Renal tumours do not project or protrude backwards to any marked extent. They fill up the hollow of the loin and may even cause some actual fulness there ; but often there is nothing more than the effacement of the natural hollow of the loin. When the tumour attains a large size the parietes may be projected laterally to a degree sufficient to be observed by a superficial glance. Sir William Jenner says : " Renal tumours never cause enlargement behind. A renal tumour is not visible in the back, it expands in front. A little greater fulness of the loin there may be, but nothing like tumour. . . . Tumours due to disease of the kidney enlarge in front ; whilst abscesses and other lesions which may simulate renal tumours often cause considerable posterior projection."

This is an important feature in relation to diagnosis, and if stated a little too absolutely it will serve the more to impress a pretty general fact. There are exceptions, however, as I shall show further on.

Auscultatory percussion, assisted by the phonendoscope, has been recommended by some of the French *cliniciens*, but has not found much favour with or proved of practical use in the hands of London physicians or surgeons.

4. " The kidney is rounded laterally, rounded in front, rounded at its inner border, rounded at its upper border, rounded at its lower border. The inner border is usually lost against the spine, and the upper border cannot be felt unless the kidney is displaced. The kidney has no sharp edges. It is rounded on every side, and in disease never loses this peculiarity " (Jenner). Whether solid or cystic, and of whatever size, a kidney tumour is prone to retain some, often much, of its natural outline. The absence of any sharp edges marks off renal from many hepatic and splenic enlargements.

5. Renal tumours descend in inspiration less frequently and less markedly than hepatic, splenic, and adrenal swellings.

Hepatic and splenic, and more especially splenic enlargements, are depressed by the contraction of the diaphragm ; whereas kidney swellings are sometimes quite unaffected by respiratory movements. If the kidney and circumrenal tissues have been inflamed the kidney will be bound down in its natural situation and there fixed. Sir W. Jenner remarks : " When the kidney is enlarged by disease it is rarely movable by respiration or palpation. When chronic changes, sufficient to enlarge the organ, have occurred, whatever their nature, adhesions sufficient to prevent movement usually form between the capsule and adjacent parts." Without doubt this is often so ; but in cases of new growths, where the organ and parts around have not been the seats of inflammation, there may be a considerable degree of movement. I have more than once seen a renal tumour descend an inch and more by a deep inspiration and fall forwards or backwards by its own weight with the movements of the body, passing in front of the spinal column when the patient has lain on' the side opposite to the tumour, and falling against the anterior abdominal wall when he has stooped or assumed the knee-elbow position. In one recorded case a renal tumour was, on account of its mobility with respiration, diagnosed as an hydatid of the liver.* I therefore agree with Dr. Dickinson when he says : " No certain inference is to be drawn from the fact that a tumour descends with inspiration," and I would . add, " or can be moved forwards and backwards by palpation."

Bright pointed out this variation as to fixity and mobility of renal enlargements in conformity with the nature of the swelling ; and he says, speaking of one of his cases : " On pushing the anterior part of the tumour backwards, the motion of the tumour was felt by the hand placed at the loin." It is to this kind of movement, long ago recognised by British physicians, that Guyon has more recently given the name *ballottement*.

6. When the pelvis of the kidney is dilated the resulting tumour may press upon the liver so as to be indistinguishable from it; it may, and often does, reach down into the iliac fossa ; and occasionally it extends inwards beyond the middle line of the abdomen. I have opened a hydro-nephrotic swelling which crossed the linea alba fully two inches. As a rule, however,

* *Deutsche Zeitschr. f. Chir.*, xxiv., 1886.

renal enlargements never invade the bony pelvis, rarely reach the median line, and frequently are separated from the hepatic dulness by a resonant area.

7. When the tumour is large enough to reach the front wall of the abdomen, the point at which it comes into contact with the anterior parietes is commonly about the level of the umbilicus, or a little higher; the lateral wall between the costal margin and the crest of the ilium is then also bulged outwards. In a case formerly under my care, the tumour—a suprarenal capsular tumour involving the kidney—presented a well-defined prominence the size of an apple immediately below the left costal margin; this prominence looked like a tumour situated in and projecting from the parietes, with its centre in the linea semilunaris, and its inner edge reaching the median line along a distance of one and a half inches; it was, however, only a part of a large tumour weighing four pounds, and completely filling the left ilio-costal space. By palpation it could readily be. moved; and it fell bodily against the anterior abdominal parietes when the patient turned from the recumbent position on to his right side; it also moved freely with respiration. Fig 76 shows the outline of the tumour after its removal by abdominal nephrectomy.

8. A symptom in the particular case referred to in the last paragraph is one which might be expected to occur in large renal tumours, especially of the left kidney, and not in splenic enlargements. There was a large varicocele of the left side, which had been gradually increasing with the growth of the tumour; and at the operation it was seen to be directly due to distortion and distension of the spermatic vein, which, with the inferior mesenteric vein, curved over the front and inner side of the tumour, and was enlarged to the size of the ring finger. When writing the " Surgical Diseases of the Kidney " in 1884 I had only met with varicocele in association with renal or suprarenal tumour once, and that on the left side. In September, 1894, I removed a large, smooth-surfaced, very movable, papillomatous epithelial new growth of the right kidney from a gentleman aged fifty-four, in which there was right varicocele which had quite disappeared on the second day after the operation. At that time I believed I was the first who had ever called attention to this symptom in connection with renal tumour, but I afterwards found that Guyon

had described this curious coincidence of varicocele with tumours
of the kidney, and had proved them to stand in relation of cause
and effect by observing the oncoming of the varicocele after the
discovery of the tumour, and noticing the increase of the
varicocele as the tumour developed.   He had met with it three
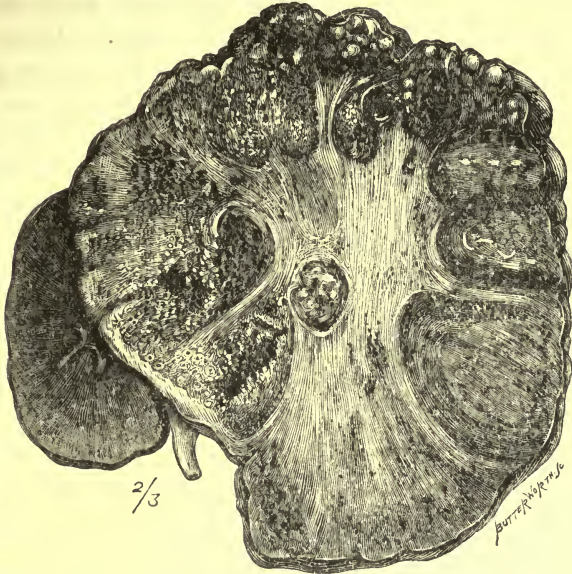times on the right and three times on the left, and the veins of

Fig. 76.—Tumour of the Adrenal, with Kidney pushed forwards upon its surface.
Removed by operation.   Author's case.

the scrotum on the same side were also enlarged in one case, and
hydrocele co-existed in two others.

There are a **few exceptional features** connected with renal
tumours which must be remembered.

1. A right renal tumour may push the ascending colon down-
wards, instead of forwards or inwards. A left renal tumour is more
likely to push the descending colon outwards, but Bright, in two
of his figures, represented it as lying vertically over the front of
the tumour.   A tumour of either kidney may push the bowel
to its inner side towards or even beyond the median line, in which
case there is no resonance in front of the tumour.*   In the case
just mentioned there was sometimes a line of resonance over a
curved area of the tumour outside the dull and prominent portion,

* _Lancet_, Aug. 29th, 1885.

and when resonance was wanting a roll of bowel could be grasped with the finger tips. The tumour had grown forwards on the inner side of the descending colon, so that in the operation the bowel had to be drawn inwards quite across the front of the mass, after dividing the outer layer of the mesocolon.

In a case under Lawson in the Middlesex Hospital some years ago, a sarcomatous tumour springing from the cellular tissue at the hilum of the left kidney bulged forwards below the umbilicus on the left of the median line and was entirely in front of the bowel. The kidney, probably as the result of the drag of the tumour, had elongated the peritoneum into a mesentery, and had then floated forwards in front of the descending colon, sigmoid flexure, and small intestine. It in some respects, therefore, resembled an ovarian tumour.* In connection with this case I may allude to one, the notes of which I extracted from the Guy's Post-mortem Records, and which I have previously mentioned amongst the causes of acquired misplacement of the kidney; the left kidney of a woman, aged fifty-seven, who died of phthisis, was displaced on to the brim of the pelvis by a large cyst in its lower part which contained a pint of fluid. The cyst had dragged down the kidney and occupied the greater part of the pelvic cavity.

2. Either a cystic or solid renal tumour may attain such a size as to occupy the greater part of the abdomen. Roberts quotes such a case of encephaloid left kidney in a boy aged six; Spencer Wells, an encephaloid in a girl aged four years; and Dickinson, a fluctuating sarcoma in a girl aged three years, which was mistaken for ascites; and a second in a girl of the same age which roughly resembled in appearance the swelling of pregnancy. I have recorded a case of cystic tumour of the left kidney in a man, which nearly filled the abdomen. In the Middlesex Hospital Museum there is a cancerous tumour weighing thirty-one pounds from the left kidney of a boy aged eight years.†

3. There are but few, if any, exceptions to the rule laid down by Sir W. Jenner, that renal tumours retain the rounded outline and never present a sharp edge; but this does not at all imply that the normal outline of the kidney is retained in all cases.

* *Lancet*, vol. i., 1866.

† *See* No. 1827, Mid. Hosp. Catalogue; and *Path. Soc. Trans.*, vol. iii., p. 268.

On the contrary, when the tumour involves only a part of the organ and not the whole, and therefore does not expand the entire capsule as it grows, it is unusual for it to have the renal outline.

4. Mobility of the tumour in respiration and by palpation is so far from being rare that it ought hardly to be enumerated amongst the exceptional symptoms.

5. A renal tumour may, as quite an exceptional thing, cause pointing on the posterior aspect of the body.   Mr. Holmes has reported a case * of pulsating cancer of the left kidney in a man forty-nine years of age.   The disease was almost confined to the left kidney, but presented a swelling over the sacrum, and caused œdema of the back as high as the neck.   The tumour weighed thirty ounces and had so destroyed the natural structure of the kidney that not a trace remained.

When renal growth or abscess affects only part of the kidney, the abdominal tumour may appear to be somewhat removed from the strict limits of the renal region.   Thus, when the upper part of the kidney is alone involved there is much upward bulging, and the tumour may be felt in the part usually occupied by the liver or the spleen.   In malignant disease of the right kidney I have seen the tumour occupy a great part of the right hypochondriac region, and simulate an hepatic tumour.

6. Little or no reliance can be placed on the absence of changes in the urine.   Solid tumours do not always cause hæmaturia, nor do accumulations of pus in the kidney always cause a discharge of purulent urine.†   The tumour may not involve the cavity of the kidney ; or the ureter may be temporarily or permanently plugged, so that the urine which is passed may be quite normal. On the other hand, however, hæmaturia and pyuria associated with the physical signs of renal tumour are valuable adjuncts in forming a diagnosis.

The best way of estimating the size of a renal swelling has been described by Rayer, Bright, Jenner, Freund, and others.   As the patient lies on his back, place the fingers of one hand flat upon the ilio-costal space just outside the erector spinæ muscle, and those of the other hand flat on the front of the abdomen just, over the hand which is behind.   Then, during expiration, and whilst the patient's attention is diverted, a very fair idea will be obtained of

* *Path. Soc. Trans.*, vol. xxiv., p. 149.
† *See* "Hunterian Lectures," 1898, Case No. 15, Table VI.

the size and weight of the organ by depressing the fingers in
front as much as possible, and tilting forward those of the
hand behind. In thin persons and with the aid of an anæs-
thetic, this mode of examination is very effective. By its adoption
a renal swelling too small to give rise to dulness on percussion
will often be detected. Excepting in children and in persons with
abnormal configuration or much emaciated, it may be stated generally
that a kidney which is recognisable by the touch is either movable,
misplaced, or enlarged by disease. Sir W. Jenner pointed out, that
when the lower dorsal and lumbar parts of the spine are curved
well forwards the kidney, even though only of natural size, may
be sufficiently prominent to be seen through the abdominal
parietes. He remarked that this condition is not uncommon
in women, and added that he once gave such a case, for examina-
tion, to the candidates for the degree of the University of London,
and was told that the tumour (a healthy kidney, though probably
somewhat larger than normal) was an ovarian tumour and should
be cut out. A spinal or a perinephric abscess, or an effusion
of blood or urine behind the kidney, may raise the kidney in
front of it into a prominence which can be easily felt if not
actually seen.

Solid fæces in the ascending or descending colon may be mis-
taken for the kidney; but perhaps a more frequent error is
to mistake an actual tumour for fæcal accumulations.

Having mentioned the usual and exceptional symptoms of
renal tumours as a class, it will be well next briefly to state
how they differ from other tumours with which they are likely
to be confused.

(A) **Tumours of the abdominal parietes** are rare. Though
sometimes difficult to distinguish from intra-peritoneal swellings
they are but little likely to be mistaken for renal enlargements.
Their mobility is affected by deep respiration only as that of
the abdominal walls is. They are either rendered less defined or,
on the contrary, more prominent by the forced action of the
muscles of the abdominal walls, according as they occupy the
deeper or more superficial planes respectively of the parietes.
Sometimes these tumours are adherent to the skin.

(B) **Enlargements of the liver.**—Renal tumours often dip
down or fade off so as to allow the fingers to be depressed
between the edge of the costal cartilages and the upper

border of the tumour. They develop an area of dulness comparatively early in the lumbar region ; whereas tumours of the liver or the spleen only do so very late, if at all. Hepatic tumours pass downwards from beneath the ribs, and so rarely do they have any intestine in front of them that the presence of bowel in front of a tumour may be regarded as a strong indication that it has not its origin in the liver. There is an absence of *ballottement*. When the tumour is of the right side a jaundiced tint of eye, or skin, or urine, and stools deficient in bilious colouring, are suggestive, to say the least, of its having an hepatic origin. A tongue-shaped lobe of the liver or a tumour developed in the concave part of the liver is very likely to cause error in diagnosis; especially so are hydatids in the left lobe of the organ.

There are rare cases in which a floating hepatic lobe closely simulates in appearance and relations, and in the presence of well-marked *ballottement*, a movable kidney. Such an abnormal lobe of the liver may be prolonged downwards in front of the kidney and give rise to a true *ballottement* in the costo-iliac region.

(C) **Enlargements of the spleen.**—The enlarged spleen has not bowel in front of it; it generally presents a sharp or well-defined edge, beneath which the fingers can be depressed ; this edge is in some cases notched. There is resonance between the posterior edge of an enlarged spleen and the spinal column, and the tumour is traceable upwards beneath the ribs. A splenic tumour is movable ; a renal tumour may be so, but in some cases it is fixed in the loin. Splenic tumour will not cause varicocele, a renal tumour may do so.

A case of " reniform spleen " has been published by Lefas in the *Bulletin de la Société Anatomiquel*, 1896. Splenic tumours increase and are displaced not vertically, but downwards and inwards, and in rare instances almost horizontally or transversely inwards. This is especially the case with leukhæmic spleens ; but malarial spleens sometimes take a vertical direction, become elongated, and have their lateral borders parallel somewhat after the manner of some tumours of the kidney (Trinkler). The spleen when enlarged by a hydatid tumour may be very irregular.

(D) **Tumours of the suprarenal capsule** are not usually of sufficient size to form an abdominal tumour, but when they

do so it is not easy, if it be possible, to distinguish them from renal tumours. Nor is it clinically of importance to do so, since new growths of the suprarenal capsule (*see* Figs. 76 and 77), when of any clinical importance from their dimensions, involve the kidney and sometimes completely efface it.

A case in which a new growth of the suprarenal capsule formed an abdominal tumour is recorded by Dr. John Ogle.* It
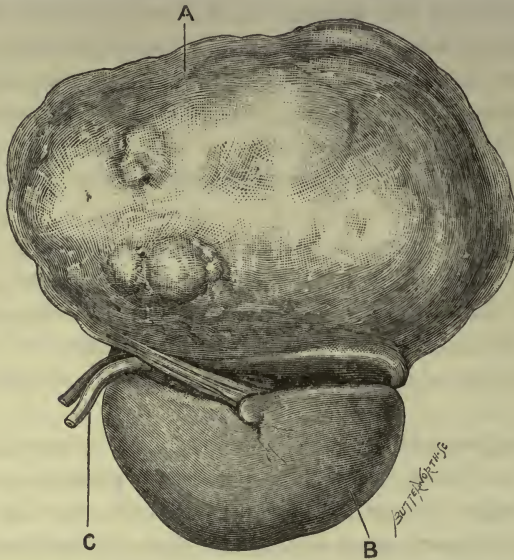

Fig. 77.—Adrenal Tumour removed from patient during life. A, Flattened area of tumour; B, lower portion of kidney unaltered; C, vessels at the hilum. Author's case. (See *Brit. Med. Journal*, Jan. 7, 1893.)

was a hard, globular, movable, " encephaloid " tumour, 6 inches in diameter, in a girl aged three years. It lay immediately beneath the abdominal wall, uncovered by any bowel, and extended between the concave margin of the kidney, which was turned forwards with the tumour, and the front wall of the abdomen. It had assumed the position but not the relations of a renal enlargement. Dr. Dickinson (who made the post-mortem examination) remarked that this suprarenal tumour was not crossed by bowel as renal tumours almost invariably are. This is a point of importance to remember, namely, that adrenal tumours are not necessarily crossed by bowel. They present in either hypochondriac region, and may be hard, rounded

* *Path. Soc. Trans.* vol. xvi., p. 250.

and movable. The skin may be hyperæmic and sallow or bronzed; on the other hand, it may not be changed at all in appearance

(E) **Ovarian Tumours**.—Both solid and cystic tumours of the kidney may be mistaken for ovarian tumours. "Solid renal tumours, whether cancerous or innocent, may resemble the malignant, pseudo-colloid, or cysto-sarcomatous tumours of the ovaries; while different varieties of ovarian cysts may be closely simulated by different forms of pyelitis, and pyo-nephrosis, hydro-nephrosis, cystic degeneration, and the growth of hydatids in the kidney" (Spencer Wells). Attention to the following points will facilitate the diagnosis : With an ovarian tumour the intestines lie behind ; both loins are resonant ; the tumour grows from below upwards, and either drags up the uterus or can be felt as a swelling in the pelvis by vaginal or rectal examination. An ovarian tumour exceptionally has intestine in front of it : (1) if of small size the bowel may not be displaced backwards by it; (2) adhesions may have formed between a coil of intestine and the front surface of the tumour, so that the bowel retains an anterior position. A careful examination of the urine should be made in every case of doubtful tumour of the abdomen. Although it is possible that a renal tumour may be present and the urine be quite normal—either because the tumour does not alter the character of the secretion, or because the healthy kidney alone secretes, or because the ureter of the diseased kidney is blocked—yet the rule is that blood, albumen, renal epithelium or pus is detected, or that there is some history of one or other of these abnormal constituents having been previously detected in the urine, in any case of renal swelling ; whereas, the probability is that they will be, and will have been throughout, absent in the case of an ovarian tumour. There are, however, many exceptions to the last part of this statement. If a correct history can be obtained it may be expected that an ovarian tumour will in all probability have been first noticed in one inguinal or iliac region and will have extended upwards and inwards. A renal tumour will have been first discovered between the false ribs and ilium, and will have extended first towards the umbilicus, next into the hypochondrium, and lastly downwards towards the groin (Spencer Wells).

I operated upon a case of deep interest in 1891, in which from the gouty tendency and the previous urinary symptoms

as well as from the clinical symptoms of the tumour, an **ovarian dermoid with a twisted pedicle** was mistaken for a hydronephrosis, due as was thought to an impacted ureteral calculus or to the pressure of a uterine myoma. The patient, a lady, aged forty-seven, had for six or seven years suffered from occasional attacks of pain in the left side of the abdomen; the attacks lasted several days, and were associated with increased frequency of micturition, highly acid urine, and the passing of a large quantity of urates and uric acid. On September 29th, 1891, she was suddenly seized with agonising pain in the left side of the abdomen—where a tumour was detected—attended with collapse, and attributed by her medical attendants to renal colic and hydronephrosis. When the pain had subsided sufficiently to allow the abdomen to be examined, a uterine myoma the size of a small melon was detected in the hypogastrium, and a large tumour rounded and elastic, was found in the left flank and extending into the left iliac fossa. This tumour was the size of a large cocoa-nut, was almost fixed in its position, with complete dulness on percussion in the loin and resonance over the whole of its front surface. On the second day after the attack the tumour was tapped through the loin and many ounces of fluid were drawn off. This fluid was found to be full of cholesterine crystals, squamous epithelial *débris*, and neutral fats.

Its dermoid nature was then diagnosed, and its connection with the ovary was proved by abdominal section, performed on November 16th, 1891. The dermoid had a long pedicle connected with the left ovary, and this pedicle was rotated two and a half times round its own axis. The cyst, engorged with blood, was quite fixed in the left loin by adhesions to the lumbar parietes, and over its front and inner surfaces the small intestines and part of the omentum were connected by recent adhesions of a vivid crimson colour. A fringe of omentum and the cyst were removed, so also were the right Fallopian tube and right ovary, which contained several small cysts. The myoma was not removed. The patient made an excellent recovery from the operation, but died subsequently of sloughing and suppuration of the myoma.

A sub-peritoneal uterine myoma in a pregnant uterus may be carried upwards, fall back into the loin and get partly covered in front and on its inner side by small intestine giving a resonant

note. A case of this sort in a lady between four and five months advanced in pregnancy was sent to me by a distinguished physician as a probable renal tumour. It, together with the increasing size of the uterus, was causing great inconvenience, sickness, and obstruction by pressure. I removed the tumour by lateral laparotomy. The patient made a good recovery and was subsequently delivered of a large child at full term.

In connection with the diagnosis of cystic tumours it must be remembered that ovarian cysts, after forming adhesions, sometimes discharge their contents through the Fallopian tube, vagina, intestines or bladder, and so by their variations in size can closely simulate those cases of hydro-nephrosis which periodically empty themselves through the ureter, or after once or oftener doing so permanently disappear.

A very small ovarian tumour with a long pedicle may be mistaken for a floating kidney, but a floating kidney can generally be recognised by its characteristic shape, its greasy feeling, and its tendency to slip upwards and backwards into the loin.

(F) **Enlargements of the lymphatic glands** in the near neighbourhood of the kidney when they give rise to a swelling have relations to the colon very similar to those of a renal tumour. The diagnosis may be made sometimes by the independent enlargement of one or more lumbar glands not forming part of the tumour; by the abruptness of the outline of the swelling; and possibly even by a protrusion from the growth along the spermatic cord into the scrotum.

(G) **From flatulent or fæcal accumulations** in the cæcum, sigmoid flexure, or colon, renal tumours may be diagnosed by the absence of intestinal disturbance, of general abdominal pains and colic, and of the enlargement by flatus which characterise over-distension of the bowel.

The proximity of the colon to the kidney renders the diagnosis between nephritic colic and intestinal colic sometimes difficult. Sir William Jenner wrote : " Nephritic colic will cause loss of power in the colon, and so induce constipation, thus favouring the idea that the patient has intestinal colic. Again, collections of stools in the colon may be mistaken for an enlarged kidney ; a large enema will solve all doubt on this point."

Before the surgeon commits himself to a definite opinion in any doubtful case of abdominal tumour. the bowels ought to have

been well opened and the examination of the tumour made immediately afterwards. It will be well to remember that just as there is incontinence of urine in retention, and incessant outpouring of fluid through the mouth in pyrosis, so there may be frequent discharge of small stools from a bowel over-loaded with fæces. An opinion should be deferred in some cases until after a second or third examination has been made, and until full time has been allowed for the removal of fæcal accumulations if there are any.

(H) **Fæcal abscess, appendicitis, or inflammation of the cellular tissue about the sigmoid flexure** will be distinguished by the marked febrile disturbance, the associated intestinal symptoms, the tenderness over the front surface of the part affected, and the lower position of the swelling, which will be in the iliac rather than in the renal region of the belly.

(J) **Malignant growths of the large intestine.**—There is a close resemblance between a malignant growth of the ascending or descending colon, less frequently also of the cæcum and sigmoid flexure, and a tumour of the kidney. I vividly recall at least six cases in which this confusion in diagnosis occurred, and I have been consulted about others. In three of my cases the cancer of the gut set up large abscesses in the perinephric tissue (see *Lancet*, April 25th, 1895). In two other cases which I have explored within the last three years there was cancer of the cæcum in one, and cancer of the ascending colon in the other. I have at the moment of writing a gentleman under treatment with what was diagnosed to be a renal tumour, but which on exploratory examination proved to be a malignant mass in the descending colon involving the hilum of the left kidney.

Other cases of a somewhat like nature are reported in the same issue of the *Lancet* (April 25th, 1895) by W. Anderson and E. Owen.

The features of resemblance between cancer of the large gut and renal tumours are the following. First, the situation and mode of increase; the growth in the colon presents in the loin, then extends forwards as far as or even beyond the semilunar line, then descends towards or for two or three inches into the iliac fossa, and afterwards may bulge somewhat backwards between the lower ribs and the iliac crest. When the growth is in the ascending or descending colon, the tumour may reach

upwards beneath the costal border, when in the cæcum or sigmoid flexure it is likely to be separated from the costal border by a line of resonance. There is dulness in the loin and an uncertain resonance in front of the tumour. Sometimes the note is distinctly resonant, at others less resonant or completely dull. The mass may move freely in a lateral or in an antero-posterior direction between the two hands placed one on the loin and the other on the front of the abdomen. When this movement is possible, the swelling is likely to be mistaken for a movable kidney. This mobility may exist even when the growth has commenced to infiltrate the antero-lateral parietes of the abdomen if the parietes are relaxed. There may be no pain whatever, or, on the contrary, there may be dull aching or radiating pains caused by pressure of the tumour on the branches of the lumbar plexus. If these symptoms of tumour and pain are associated with blood or albumen in the urine, malignant renal tumour or hydronephrosis due to renal calculus will be suspected. Sometimes albuminuria or hæmaturia is present. Albumen was occasionally found in the urine of one of my patients; this was due to pressure on the renal vessels, the cellulo-fatty tissue surrounding and extending into the hilum having been invaded by the new growth. Variable albuminuria and occasional hæmaturia with steady diminution in the amount of urea were marked symptoms in W. Anderson's case of tumour in the left loin already referred to; the condition simulated hydro-nephrosis and was caused by carcinoma of the descending colon.

Cancer of the large gut rarely has the form of the kidney. It should be suspected if, as is very likely to be the case, the tumour is associated with diarrhœa or possibly with loose blood-stained actions of the bowels or other intestinal symptoms. In some cases ball-like masses due to portions of bowel distended with flatus and causing marked peristalsis have been noticed; in others incomplete obstruction of the bowel has occurred and has led the surgeon to think the growth was not renal, but intestinal. Even this symptom is fallacious, because partial or even complete obstruction may be due to displacement of and pressure on the colon by a renal growth, or by constriction due to adhesions of the mesentery to the front of the tumour.

An exploratory incision in the loin will reveal the kidney unaffected, or involved only indirectly by the extension of the

growth in the surrounding perinephric tissues, and it may not be possible entirely to expose the mass from the lumbar wound. Such cases teach us to approach these tumours in a cautious manner, giving a guarded diagnosis, and undertaking an operation in a spirit prepared for a surprise and ready to meet with conditions of an inoperable kind.

It is noteworthy that in three cases these growths of the colon set up extensive perinephric abscesses, probably by ulcerating through the intestinal walls at a spot uncovered by peritoneum. Sometimes a renal tumour, on the other hand, ulcerates into the colon and causes fæcal extravasation into the peritoneal cavity.

(K) **Tumours of the mesentery** are more median, nearer the umbilicus and the anterior parietes, more movable, especially in a lateral direction, and have a zone of resonance all around them due to their relation to the small intestine. A movable kidney would have more vertical and less lateral movement, and would be capable of being pushed back into the recess of the loin.

(L) **Tumours of the omentum** are very movable laterally and in an upward direction. They project prominently against the anterior abdominal wall, and give a dull note on percussion.

(M) **Tumours of the pancreas,** whether cystic or cancerous, are more median in position, their chief mobility is vertical, ·and they may cause obstruction of the pancreatic and common bile-ducts. Pancreatic cysts fluctuate and give a hydro-aërial bruit in front of them (Le Dentu). It is only with left-sided renal tumours that the confusion with those of the pancreas is likely to arise. Hydro-nephrosis of the left kidney when it causes a tumour is placed more in the loin and descends more into the iliac fossa than does a cyst of the pancreas, and the distended colon passes vertically over its front surface or is displaced to its outer side instead of crossing it transversely or lying below it, which is the usual relation of the colon to a cyst of the pancreas.

(N) **Enlargements of the gall-bladder** are liable to be mistaken for renal swellings, and more especially perhaps for movable kidney (*see* p. 123, " Movable Kidney ").

(O) **Perinephric lipomata** are liable to be mistaken for renal tumours. Their symptoms and diagnosis are discussed in Chapter XXIII., Vol. II., p. 14.

CHAPTER XIX.

TUMOURS OF THE RENAL PARENCHYMA.

WE have to study renal new growths, (1) of the renal paren-
chyma ; (2) of the renal cavity, *i.e.* within the calyces and pelvis
of the kidney ; and (3) of the renal capsule, and of the tissue
around it, comprising what have been called the perinephric
and paranephric tumours.

We will first consider the new growths affecting the renal
parenchyma, and afterwards separately describe those of the
renal cavity, the renal capsule, and the perinephric tissue.

Three classes of new growths affect the substance of the kidney :
(A) The malignant, including the epithelial and sarcomatous
tumours ; (B) the non-malignant solid tumours, *i.e.* lipoma, fibroma,
myo-lipoma, myxoma, angeioma, *et cetera ;* and (C) the cysts of
the kidney, *i.e.* cysts consecutive to nephritis, serous cysts, der-
moids, hydatid cysts, and the polycystic kidney.

(A) MALIGNANT TUMOURS IN THE ADULT.

The malignant tumours tend to infiltrate contiguous structures,
invade the lymph tracts, and generalise in the system, or, in
other words, set up secondary growths in near and distant organs
and parts. They are thus distinguished from the other class of
solid tumours — the non-malignant — which merely interfere by
direct pressure with neighbouring tissues or organs. The whole
class of malignant renal tumours have sometimes been erroneously
denominated cancer of the kidney.

The class, however, includes both the epithelial and the meso·
blastic growths. The epithelial comprise the adenomata and the
epitheliomata ; whilst the mesoblastic growths, *i.e.* those of con-
nective tissue origin, include all the sarcomata, whether pure or
mixed with striped or unstriped muscular fibres, or with cartilage,
or with angeiomatous or other forms of tissue. According to
several observers, a certain number of new growths are com-
posed of connective and of epithelial structures blended in
different proportions, thus forming *adeno-sarcoma.*

Malignant tumours include also tumours less virulent than

epithelioma and sarcoma, namely, lymphadenoma; as well as the pathological development of supernumerary adrenals included within the capsule of the kidney, first described by Grawitz in 1883, and to which the names *struma renalis* and *supra-renalis* have been given.

Etiology.—Carcinoma, sarcoma, struma supra-renalis and myo sarcoma or rhabdo-myoma occasionally occur as primary new growths in the kidney. Carcinoma and sarcoma are much more frequently secondary than primary. Injury and the irritation of
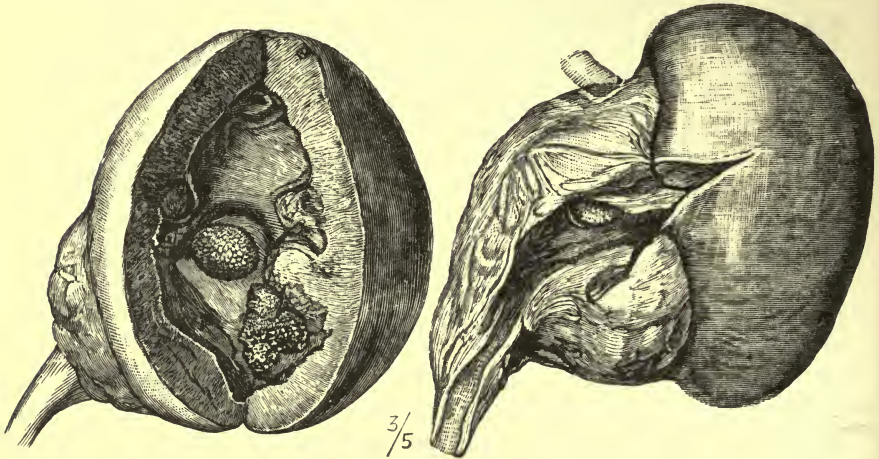
Fig. 78.—Two Views of the same (right) Kidney removed after death from a Woman who died of Cirrhosis of the Liver. (Middlesex Hospital Museum, No. 1795.)

A sarcomatous tumour, the size of a fist, is attached to the hilum and completely surrounds the pelvis and commencement of the ureter. The pelvis of the kidney is dilated, and contains two rough dark calculi, one of which is spherical and the other branched.

a calculus (Fig. 78) have, in several recorded cases, been the cause of primary cancer (Pollard, Shattock, Newman). Secondary carcinoma has, in quite a considerable number of recorded cases, been preceded by carcinoma testis; in other cases it has followed cancer of the liver, stomach, breast, or uterus.

As a primary disease malignant new growths affect one organ alone, except in some cases of congenital sarcoma, in which both kidneys are affected without at first other organs being involved. As a secondary disease, usually both kidneys are invaded. The instances to the contrary, according to Guillet amounting to seven in seventy-eight cases derived from autopsies, are probably

instances of secondary infection long delayed. Sarcoma occurs as a primary disease in children, before the fourth or fifth year; and in adults in advanced life. As a result of stone or laceration it has caused death at the age of twenty-five. Though somewhat rapidly fatal after it has once commenced, a malignant neoplasm may take a long time before it is excited into existence : thus, twenty years have elapsed between a fall which gave rise to a renal calculus with a blood-clot for its nucleus, and death from primary cancer of the kidney in which the calculus was situated.

Of thirty cases of malignant disease, including cancer, sarcoma, adenoma, and lymphadenoma of the kidney, found in 2,610 post-mortem inspections at the Middlesex Hospital, twenty-five were secondary and five primary.

Of the five primary growths two were hard carcinoma and three encephaloid. In one case (a male aged seventy-six) the right kidney was infiltrated with a firm white growth; it was enormously enlarged, weighed forty-nine ounces, and contained several large irregular calculi. Probably the calculi had been the exciting cause of the disease. In this case, and in one other (a male aged sixty-four), in which the right kidney was converted into a mass of encephaloid cancer as large as a melon, the disease was confined to the kidney; in the other three cases there was secondary disease in other organs. In one the liver and colon, in another the liver and retro-peritoneal glands, and in the third the pancreas and omentum, were the parts thus secondarily affected.

Of the *twenty-five* cases in which the kidney was affected secondarily, ten were in males, fifteen in females. The primary seats of disease were the female breast in five ; the female genital organs and bladder in four ; the rectum in two ; the omentum, duodenum, and liver each in one ; *lymphadenoma* of the stomach in one, and of the prostate in one ; *sarcoma* of the arm, of the axilla, of the pleura, of the orbit, of a fibroma of the uterus, and of the spinal dura mater each in one ; *epithelioma* of the tongue in one, and of the cervical glands in one. In a further survey of the more recent records of the Middlesex Hospital, sixty-nine cases of malignant disease of the kidney were found in 3,926 post-mortem examinations. Of these, fifty-four were secondary and fifteen primary new growths. Of the fifteen primary tumours of the kidney thirteen were carcinoma and two adenoma.

Pathology. — 1. *The Adenomata.*—Recent histological re-
searches appear to show the malignancy of certain forms of
adenomata, and especially of the form denominated by Grawitz
struma supra-renalis. Sturm in 1875 pointed out that renal
carcinoma may take the form of adenoma, consisting of a true
proliferation of convoluted tubules, which ultimately may be trans-
formed into cancer. Grawitz, Sudeck, Sabourin and Œttinger
have reported cases of adenoma of the kidney followed by secon-
dary deposits of like nature in the lung ; and with them Pilliet,
Senator, Sottas, and Albarran all agree that certain renal
adenomata behave like malignant tumours, both in their local
and distant effects ; that distinction between adenoma and
carcinoma is sometimes most difficult ; that transition forms
occur in the kidney more especially and more markedly than in
any other organs ; that it is impossible either from the micro-
scopical or from the macroscopical characters to establish precise
limits between adenomata and epitheliomata ; and further, that
an adenoma is sometimes only the beginning of an epithelioma.
There are several instances in which tumours of the kidney have
from their histological characters been described under the name
of adeno-carcinoma, and from their clinical and histological fea-
tures combined as " malignant adenoma." From the clinical point
of view, adenomata often increase in size, and give rise to meta-
static growths, and provoke cachexia and death like other malig-
nant new growths.

An example of congenital cystic adenoma in an infant of ten
months, which proved to be malignant, has been recorded by Edgar
Willett in the *Transactions* of the Pathological Society (1895). The
cut surface showed a large tumour projecting from the outer border
of the kidney, and pushing the cortex, nearly the whole of which was
involved, to one side. A well-marked capsule separated the kidney
substance from the tumour, which was glandular in appearance and
consisted of minute cysts just visible to the naked eye. On the outer
surface the capsule of the kidney was thinly spread out over the new
growth. Microscopically the structure consisted of numerous minute
cysts, of various sizes, each of which was lined by a single layer
of short cubical epithelium. The essentially glandular look of the
tumour seemed at the time (the tumour was removed by opera-
tion) to warrant its being considered an adenoma, especially
as there was a definite limiting membrane to the growth. Sub-

sequently, it proved to be malignant, and eleven months later a recurrence took place, and the child died.

The struma supra-renalis of Grawitz, or the development of a supernumerary adrenal enclosed within the capsule of the kidney into a renal tumour, has sometimes been considered a benign tumour, but many of them are in course and termination malignant. The nature of some primary tumours of the kidney is similar to the normal adrenal tissue, but in others, "while some portions simulate suprarenal tissue, other parts closely resemble an alveolar sarcoma, and some districts have an appearance which, I believe, many would be inclined to term carcinomatous" (Kelynack). Some are identical in structure with adrenal adenomata. These, when of small size, are the tumours described by Robin as *intrarenal lipomata*. Grawitz, in 1883, pointed out that these so-called renal lipomata have the structure of the suprarenal capsules, and he propounded the theory that they are small adenomata arising from small masses of the suprarenal gland included within the kidney. He proposed to call them *strumæ lipomatodes aberratæ renis*. He supported his opinion by the following arguments : (1) The sub-capsular situation ; (2) the complete difference between the cells of the tumours and the cells of the uriniferous tubes ; (3) the presence of fat globules within the cells, and their morphological resemblance to those of the adrenal cortex ; (4) the separation of these tumours from the renal parenchyma by a connective tissue capsule ; (5) the characteristic arrangement of cells in the tumour in single or double layers separated by capillary vessels, which gives it the appearance of the cortical part of the suprarenal capsule ; (6) the simultaneous occurrence of amyloid degeneration of the vessels of the tumour and of the capsule of the adrenals. Grawitz's ingenious hypothesis that certain tumours of the kidney arise from small adrenal "rests" embedded within or beneath the capsule of the kidney has been pretty generally accepted. Indeed, as Mr. Targett suggests, it is a question whether it has not been somewhat too frequently applied, with the result that some ordinary renal carcinomata have been referred to this extraordinary class. Such a mistake is quite compatible with the opposite one, namely, that some primary tumours of the suprarenal gland have been regarded as primary tumours of the kidney. Lubarsch, in support of Grawitz's view, insists also upon other

similarities in the cell formation of these tumours and the supra-renal capsule, and especially on the presence of glycogen in both. Horn concludes that all the adenomata of the kidney have this origin. Sudeck, on the other hand, energetically disputes the theory of Grawitz. In answer to the question to what class of tumours do the struma supra-renalis of Grawitz belong, Strubing and Resenstein recognise some as benign, some as malignant, but clinically the local symptoms do not permit of a distinction being made between the two sets of cases. Some speak of them as adenomatous, some as carcinomatous, some as sarcomatous, and Driessen considers they are endotheliomatous. Thus their nature is far from being settled, though it is a recognised fact of great importance that they have in many instances all the characters of malignancy. Israel, Perthes, Lotheissen, and Askanazy give cases, some in men, some in women, between the ages of forty-two and sixty-four, of renal tumours of this kind which have been removed and have subsequently recurred locally and in the lungs and pleura and bones within periods varying from four months to a year and a half.* Bayard Holmes has recorded a case of adrenal tumour in a man aged fifty-six, with marked con-stitutional symptoms and secondary growths, and this same author stated that about one-third of all tumours of the kidney appearing in adult life are of adrenal origin, but only a small proportion of them show a tendency to metastases, and that these metastatic foci are usually confined to the lungs or bones, and only rarely are they found in both. There is unquestionable evidence to show that instances, by no means very rare, of tumours named by the German observers struma supra-renalis are very malignant, from the point of view both of quick recurrence and of wide diffusion ; and consequently that they, like some other forms of adenomata, ought to be included amongst malignant new growths of the kidney. It is conceded, however, that many instances of the struma supra-renalis, and many of the other varieties of adenomata, are benign ; but at the same time it is held to be impossible to distinguish clinically or microscopically the benign tumours from those which assume all the characters of malignancy, and it is considered, therefore, that they ought to be grouped with the malignant tumours in considering them from the point of view of treatment.

* *Amer. Med. Assoc. Journ.*, 1898, p. 405.

Adenomata are spheroidal in shape, encapsuled, often of con-
siderable size, forming a prominence on the outer surface of the
kidney as large as an orange, or larger; or they may
occupy the kidney above or below the hilum, leaving the other
part of the organ quite normal. There may be many cysts,
and also hæmorrhages seen on section. The capsule is often thick
and fibrous, and sends processes across the tumour. The stroma
is frequently very scanty. The microscopical appearances are
those of spaces or tubes lined with epithelial cells like renal
epithelium; in other parts there may be masses of cells of the
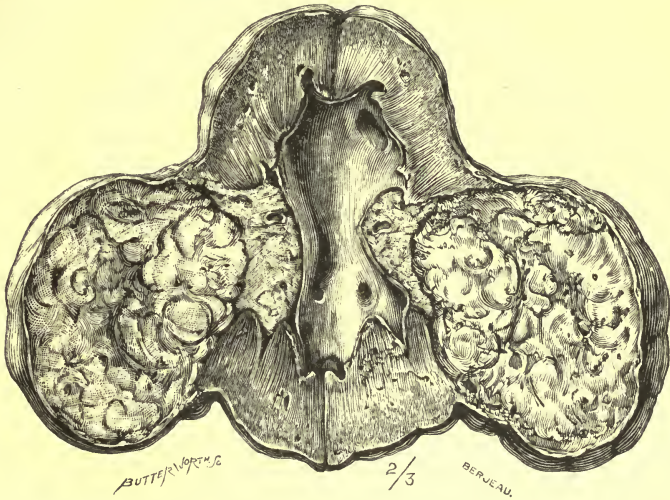
Fig. 79.—An Adrenal " Rest " Tumour, described in the Catalogue as a Spheroidal-
celled Carcinoma of Kidney; encysted form. (Guy's Museum.)
(See Targett, *Trans. Path. Soc. Lond.*, vol. xlvii., p. 123, 1896.)

same type, and delicate branching papillary out-growths covered
with the same kind of cubical epithelium may fill the tubes.

2. *Carcinomata.* — Renal cancer is found almost exclusively
in adults and those advancing or advanced in life, most fre-
quently between forty and sixty. Primary cancer of the kidney is
more common on the right side than the left. Where the point
is mentioned in the twenty-eight cases collected by Guillet, it is in
the proportion of seven to three. In cases recorded in my own
lists, collected from English literature (1884 to 1893), it was in
the proportion of ten to six, and in American journals during
the same period, four to three. It is also more frequently met
with in men than women, thirteen to three in the English

cases, though in the American it is as two to five, and in
Guillet's cases about twice as frequent in men as in women,
sixty-four men to thirty-five women out of ninety-nine cases.

Cancer affects the kidney in two forms, the diffused and the
encysted (Figs. 79, 80). It is rare for the tumour tissue
so completely to replace the renal parenchyma that the latter
entirely disappears; and it is also seldom that it is diffused
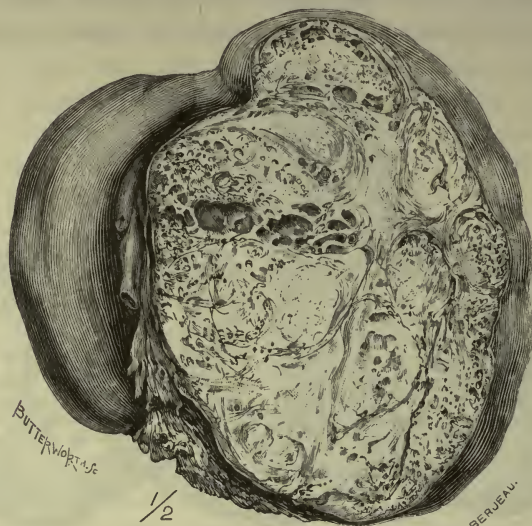uniformly throughout the organ. Commonly, one finds that it

Fig. 80.—Section, showing Alveolar Carcinoma. The Capsule of the Kidney is
continued over the surface of the Tumour. (St. Thomas's Hospital Museum.)

has destroyed a more or less considerable part of the organ
—the superior or inferior third or half—leaving the rest of the
kidney tissue unaltered in appearance to the naked eye. The
proper capsule of the kidney, often much thickened, is continued
over the surface of the tumour (Figs. 80, 81). On section, the
margin of the tumour projecting into the parenchyma is rounded
and regular in outline, and is limited frequently on this aspect by a
capsule; but the capsule may be wanting, and then the new growth
infiltrates the tissue and has not a definite outline. In some cases
two or more separate encapsuled masses occupy the kidney.

When the cancer infiltrates the kidney, it may increase its
volume without altering its shape, the capsule being thickened
and having large veins ramifying upon it. In the more

advanced stages the capsule may rupture or become perforated by the growth at several points ; or the growth may invade the renal pelvis and the ureter, and spread along the latter even as far as the bladder, which it has been known to enter. The size attained by epithelial cancer is very variable, ranging from less than that of a nut to tumours larger than the adult head. They do not often reach such large dimensions as the sarcomata. The shape of the kidney is maintained when the cancer is
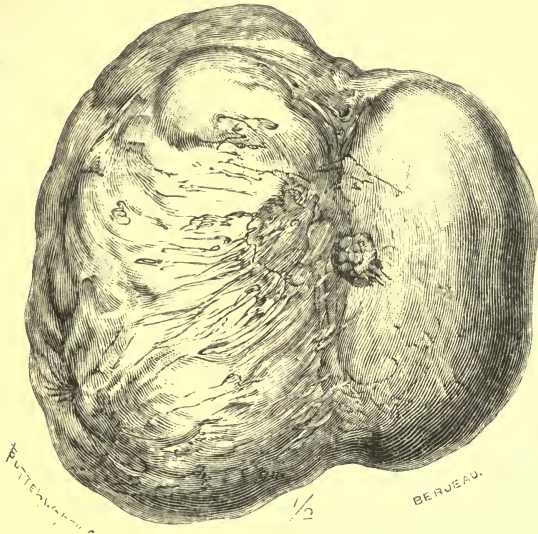

Fig. 81.—From the same Kidney as Fig. 80, showing the continuation of the Renal Capsule, or what looks to be so, over the Hilum.

small or of only moderate size (Fig. 82), but it is lost when the tumour attains a large size and when it becomes irregular and nodular in outline (Figs. 79 and 81). The tumour may give rise to dilatation of the stomach by pressure or by displacement of the pyloric end ; the fatty capsule adheres more or less intimately to the growth and as the tumour increases it comes into relation and forms adhesions with neighbouring organs, viz. the liver, spleen, colon, duodenum, inferior vena cava (Elliott, *Lancet,* 1879, vol. xi., p. 423), or aorta. Pescher * records a case in which there were extensive adhesions between a primary carcinoma of the kidney and the colon, with numerous perforations of the colon, allowing of the escape of fæcal matter

* Pescher, *Sajou's Annual of the Medical Sciences,* 1889, p. 30.

into the peritoneum. Piegné also records a somewhat similar
case (*Bull. de la Soc. Anat.*, Avril 30, 1888). Rayer published
a case in which the duodenum was invaded.

The renal capsule may contain secondary isolated nodules, as
in my case, illustrated below, Fig. 82.

The adhesions to the vena cava of tumours of the right
kidney are more frequent than those of the tumours of the left

Fig. 82.—Epithelioma of Kidney, with Clot in the Renal Vein. Removed by Author.

kidney to the aorta, and they are particularly dangerous, being
likely to result in rupture of the vein if an attempt be made to
perform nephrectomy. Quenu (*Bull. de la Soc. Chir.*, Juillet, 1888)
speaks of the occurrence of peritonitis dependent on renal cancer.

Some of the cancerous tumours of the kidney, which on the
surface are more or less smooth, present on section an enormous
cyst, with shaggy flocculent walls containing soft greyish or
yellowish-white or brain-like new growth, into which blood ex-
travasations have occurred, so that the tumour-tissue is mixed
with blood-clots more or less altered in colour.

On section, wide bands of fibrous tissue connected with the capsule may divide up the tumour into a series of lobules. Sometimes there are cyst-like cavities containing blood or a semi-gelatinous substance.

In other cases the tumour·has an alveolar appearance, honeycombed in places, the tissue around being firm. Such was the structure of the new growths in two kidneys recently removed by me.

Case I.—A kidney removed from a man in 1899 was much enlarged, measuring ten inches by seven inches. On the surface it was lacerated.

It was greatly distended and sacculated, and there was but little normal renal tissue left. It had the general appearance of a large tuberculous kidney.

In the lower half the walls of the sacculi were thickened and nodular, as if composed of new growth. The nodular masses were pale and hard. There were no distinct evidences of tubercle. The interior of each sacculus was roughened and shaggy.

Microscopical appearances.— The tumour was composed of bands of fibrous tissue, so arranged as to enclose alveolar spaces which were occupied by

Fig. 83.—Kidney with Clot enlarged and measuring 6½ inches in long axis, and 3¼ inches in transverse axis. u, renal pelvis; v, renal vein; a, renal artery. Author's case. (From same specimen as Fig. 82.)

epithelial cells, many of them typically squamous. In some places structures like " cell nests " could be seen ; in other places the epithelial columns appeared as tubes with a central lumen.

Case II.—A kidney removed from a woman on June 26, 1899, was about the normal size. The capsule was thickened and adherent, and cut as if it were calcified in parts.

In the lower half, a hard rounded mass could be seen, which on section measured about two and a quarter inches in diameter.
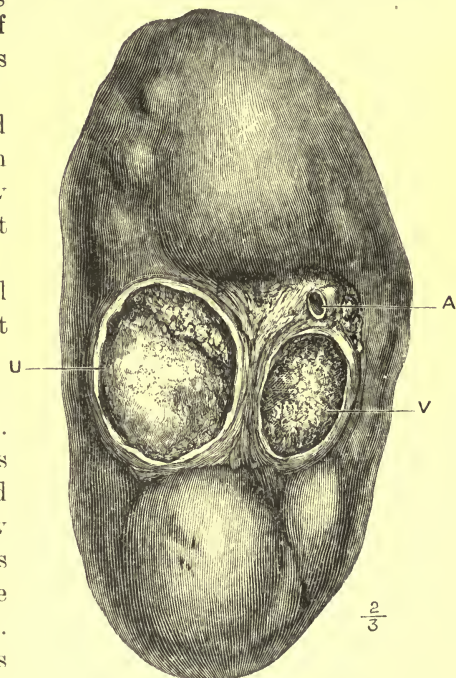
This mass was not encapsuled, was pale and mottled, and generally firm. It appeared to be an infiltrating new growth. The upper part of the organ was healthy.

Under the microscope the main mass of the tumour was seen to be composed of very delicate flattened cells (either epithelial or endothelial), which were embedded in a very delicate connective tissue stroma. In places the arrangement was roughly alveolar, in others it was very indistinct.

The naked-eye resemblance of renal carcinomata to caseous tuberculous deposit is in some cases very close indeed.

I removed on one occasion from a very thin, spare, middle-aged man a tumour which filled more than half the belly and from which a large quantity of diffluent or nearly fluid contents escaped, leaving a large collapsed cyst to be removed. It gave at the time more the impression of a huge, almost completely liquefied, tuberculous cyst, but on microscopic examination it proved to be an epitheliomatous cancer, which recurred and killed the patient within four months from the date of the nephrectomy. Horn, Strubing, Le Dentu, and others have recorded somewhat similar cases.

Cancer spreads by invasion of, *i.e.* by continuity into, the surrounding tissues, as well as by forming adhesions with the neighbouring organs as stated above. The size of the tumour *does* not necessarily imply adhesions; some tumours of very large size have been quite free from them.

The growth may invade the renal vein, causing thrombosis, and giving rise to simple and infective emboli; it may spread along the renal vein into the inferior vena cava, and thence extend along the large trunk vein a considerable distance, enlarging it in doing so to an enormous degree* (*see* Fig. 85). From the vena cava the growth may also spread into the renal vein of the opposite side.†

In some cases, what looks like the invasion of a vein by new growth is only decolorised blood-clot, as in Fig. 83. The aorta is very rarely affected in this way; but the renal artery is often enlarged, hypertrophied and dilated. The vertebral column has been destroyed, causing neuralgia of the cauda-equina and paraplegia, as in cases recorded by Lepine (*Lyon Médicale*) and Cornil

* Coyne and Troisier (*Bul. de la Soc. Méd.*, 1871, p. 239).
† Lepine, *Revue de Méd.*, 1888 viii., 1024.

(*Bull. de l'Académ. de Méd.*, 1866); and also in a case I attended with Dr. Cambridge of Finsbury Park. The calyces, pelvis, and upper part of the ureter may be invaded and filled with a fœtid, semi-solid mass composed of blood, urine, and cancerous *débris*.

Albarran records a very interesting case in which a button of the new growth obstructed the ureter and caused a hydro-nephrosis. Not detecting the presence of this growth in the renal cavity, he performed nephrotomy, and let out of the sac a quantity of quite clear liquid and a small fragment of tissue which looked like false membrane ; he then fixed the kidney. The microscope showed this fragment to have the characteristic structure of epithelioma of the kidney, and thirty days later he performed nephrectomy, and ascertained the presence of a central new growth. Hildebrandt has published a similar case (*Arch. für Klin. Chir.*, Bd. lvii., 1896, p. 224).

Secondary infections occur through the lymphatics, and most frequently involve the lungs and liver. Metastases sometimes occur with renal carcinoma of small size, and with tumours having the microscopic characters of adenoma. The lymphatic glands along the vertebral column and at the renal pelvis some-times attain a very large size and form a tumour larger than the renal tumour, and with which they may be amalgamated.

If the spermatic vein is compressed by the renal tumour or by the enlarged glands, or if the left renal vein is plugged by thrombus, a varicocele is developed on the corresponding side.

Besides the renal epitheliomata having the ordinary struc-ture of carcinoma, Albarran describes a second variety of tumours, which he has named *épithélioma à cellules claires*, and which he considers are very characteristic. A great number of new growths of the kidney present, according to him, an alveolar structure and clear cells, such as are described as occurring in adenomata of the large tubular form.

Some of the tumours, even when of large size, are uniformly so composed, whilst others consist partly of epithelioma with clear cells, and partly of portions having the tubular structure exactly like the ordinary form of epithelioma.

3. *Sarcomata* sometimes infiltrate the whole of the kidney, which meanwhile preserves its ordinary form, at other times they commence in the centre of the parenchyma, being surrounded by a thin layer of renal tissue ; rarely, when commencing in

the capsule, they surround the kidney, the normal tissue of which is preserved; but most frequently the sarcoma forms a tumour which is developed at one point and rapidly destroys the rest of the organ. It may commence in or invade the wall of a large cyst without invading the renal parenchyma, as in the case of adrenal tumour from which Fig. 86 was taken.

At its outset the sarcoma appears in certain cases separated

Fig. 84.—Multiple Sarcomata of Kidney, encapsuled with fibrous bands passing inwards from capsule and dividing the growth into lobules. (Guy's Hospital, No. 1658.)

by a capsule from the kidney (Fig. 84); but often there is no capsule; and where it exists the capsule often bursts at some small point and the tumour infiltrates, through this point of rupture, the rest of the renal tissue.

Sarcomata sometimes form enormous tumours which fill more than half the belly; they are lobulated, being firm in some cases and partially or totally softened in others. On section they often show hæmorrhagic foci and pseudo-cysts.

Perhaps two of the most remarkable features in connection

with sarcomata are the enormous size to which such growths attain and the fact of their occurrence in early childhood. Tumours of
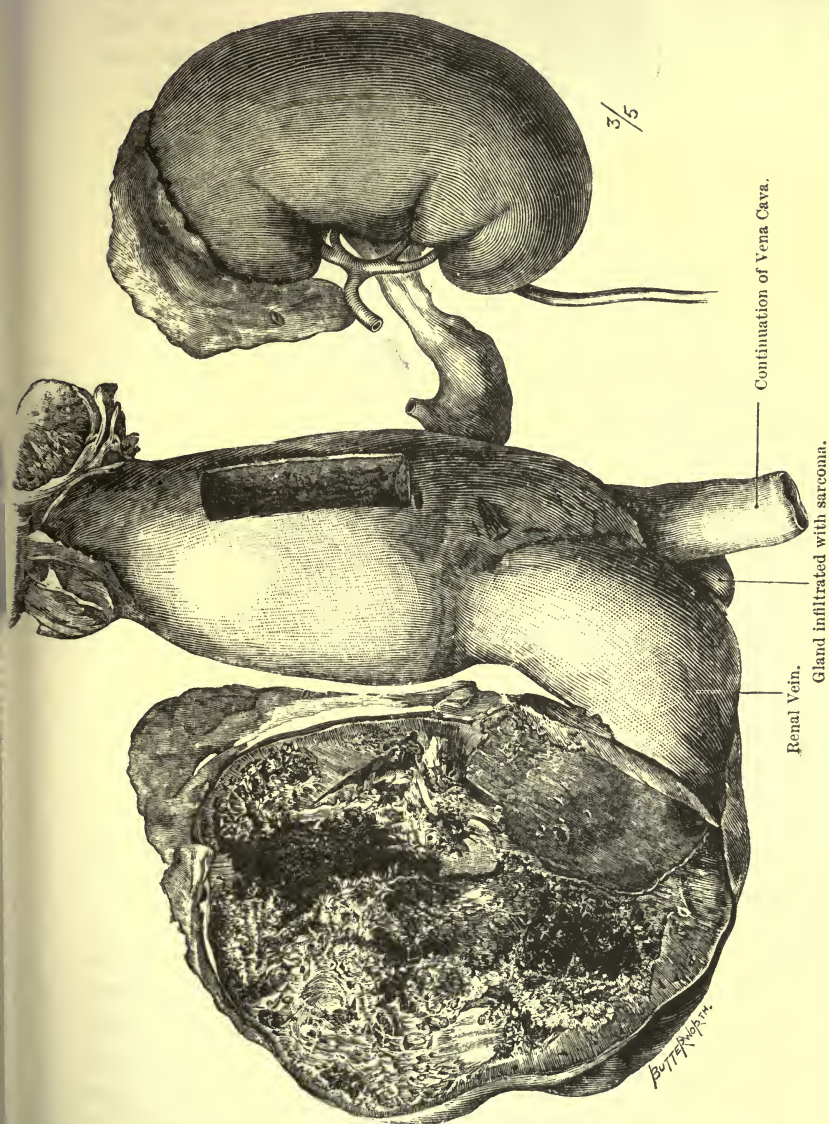

Fig. 85.—Sarcoma of Kidney, extending into the Vena Cava. The growth distended the vena cava to a great size, and, extending upwards, actually involved the wall of the right auricle of the heart. (Middlesex Hospital Museum.)

Continuation of Vena Cava.

Gland infiltrated with sarcoma.

Renal Vein.

as much as 20 lbs. weight have been found in quite young children* occurring and proving fatal between birth and the fifth

* Audain (d'Haïti), "Sarcoma du Rein," *Union Médicale*, May, 1875.
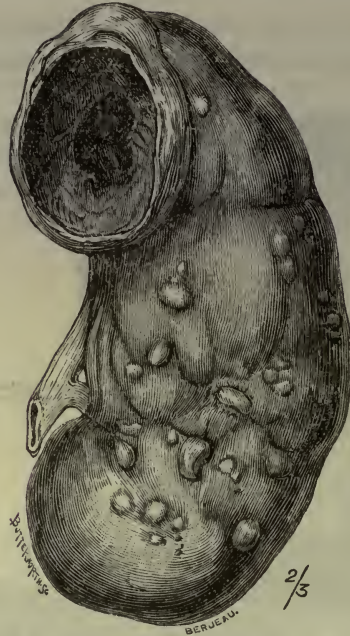
Fig. 86.—Cysts in the Kidney, one at the upper end was developed into a large
tumour containing gelatinous grumous fluid, and its wall was the seat of a
mixed-celled sarcoma.   The tumour originated in the adrenal.   There was no
new growth in the kidney itself.   This same kidney is shown in section in Fig.
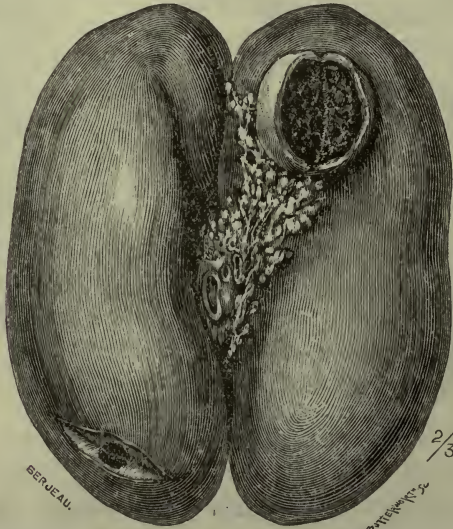33, p. 271.   (Removed by the Author.)

Fig. 87.—Melanotic Sarcoma of Kidney and Perinephric tissue. A small growth an eighth
of an inch in diameter is seen in the cortex, and a similar growth as large as a
filbert in the connective tissue over the kidney.   (St. Thomas's Hospital Museum.)

year. In a small portion of the cases sarcomata in children are
bilateral. Between five and fifteen years of age these growths
are not met with, but in later years of adolescence and to the
age of sixty unilateral sarcoma is pretty frequent. It is not
often seen in persons over sixty.

Though attaining great size some sarcomata remain circum-

Fig. 88.—Melanotic Sarcomata (probably secondary) in the Perinephric Tissue.
      Presented by Astley Cooper. There were also melanotic growths in the skin,
      omentum, and abdominal lymphatics. (Guy's Hospital, No. 1662.)

scribed without invading neighbouring organs, or becoming
generalised. But as a rule they rapidly invade the vena cava,
the ureter, and the lymphatic glands, and generalise themselves by
secondary deposits which are found chiefly in the lungs, liver
and brain.

Melanotic sarcomata are almost always if not invariably secondary
when met with in the kidney. In each of the cases from which
Figs. 87, 88, and 89 were taken the melanotic sarcomata in the
perinephric tissue, cortex, and capsule of the kidney were secondary.

Melanotic discoloration of cancerous and sarcomatous renal tumours is of occasional occurrence; and Dickinson has pointed out that melanotic formations may be found in the kidney independently of any morbid growth and simply as a development of pigment cells in the interstitial tissue of the organ.

Dickinson gives an illustration taken from a specimen in the Hunterian Museum which he had examined microscopically, showing black spots unattended with any swelling or displacement of structure scattered throughout the medulla and cortex and in the capsule of the kidney.   These were caused by masses

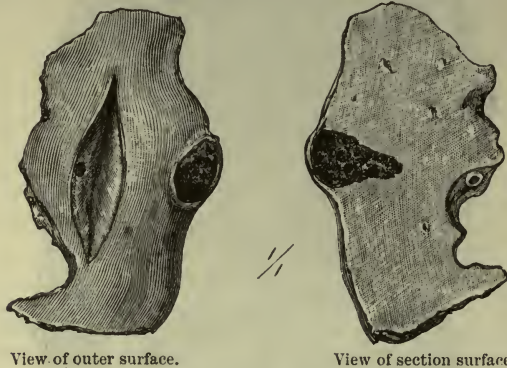View of outer surface.   View of section surface.

Fig. 89.—Portion of Kidney with Melanotic Sarcoma, from a woman, aged 40, who died with ascites.   Melanotic growths were also found in the skin, pleura, peritoneum, liver and spleen.   (Guy's Hospital, No. 1661.)

of pigment cells varying in size from a pin's head or smaller to a pea or rather larger. "The cells were situated wholly in the interlobular district of the kidney, leaving the tubes and Malpighian bodies unaffected, but often strikingly outlined by the black matter.   There was no evidence of new fibroid growth or stroma."

In the Hunterian Museum is another kidney uniformly blackened by a similar change, and at the London Hospital is a specimen "looking as if lampblack had been inserted into round cavities."   Dickinson adds, "Clinically the history of melanosis is that of the growth with which the pigment is associated," and he refers to Fagge's cases* to show that in melanotic sarcoma the urine has been proved to contain black pigment either in casts, granules, or solution.

* *Trans. Path. Soc. Lond.* vol. xxviii., p. 172 (1877).

There are numerous forms of sarcoma varying according to the different kinds of cells of which the growth may be composed, to the arrangement of these cells, and to their admixture with various tissue developments. The round-celled vascular variety is soft and grows rapidly ; it is the most common, and composed twenty-three out of forty-three tumours in children operated upon since 1890. The spindle-celled form is firm, of slower growth and less marked malignancy ; it is much rarer than the round-celled sarcoma. Myxo-sarcoma rapidly attains a large size without giving rise to much pain and often without metastasis ; it occurred in five cases out of forty-three sarcomata operated upon in children since 1890.

Lympho-sarcoma.—Tumours occur in which one part resembles a growth of lymphatic origin and another part a small round-celled sarcoma. The cases of so-called lympho-sarcoma of the kidney sometimes resemble large white kidneys. The new growth is diffused throughout more or less of the organ. Both kidneys, and other organs as well, are usually affected. Probably the kidneys are always involved secondarily to the retroperitoneal or mesenteric glands. The growths are composed, of round cells with large nuclei contained in a delicate network of interlacing fibres, Heresco found only one case of lymphosarcoma amongst 165 instances in which nephrectomy had been performed for malignant tumours of the kidney. The patient was a girl of two years of age, from whom Brun removed the right kidney. The child died of recurrence three months after the operation.

Dr. Parkes Weber brought before the Pathological Society in 1896 the kidneys of a girl aged five, enlarged to three or four times their natural size by diffuse symmetrical lympho-sarcomatous infiltration, associated with deposits in the cæcum, appendix, diaphragm, pericardium, and some of the mesenteric and mediastinal glands. The liver to the naked eye was unaffected. The history of the illness is very defective, but the urine was reported to have contained a considerable amount of albumen, a few casts, but no red blood-corpuscles.

Mr. Jackson Clarke in a discussion on lymphadenoma and its relation to other morbid growths, introduced by Mr. W. G. Spencer, stated that he found nineteen cases of lympho-sarcoma in 730 consecutive autopsies, as compared with thirty-nine cases

of other forms of malignant neoplasms. Of these thirty-nine
instances the kidney was only once the seat of disease ; it is not
stated how often the kidney was involved in the nineteen lympho-
sarcomas. His observation of these nineteen cases, however,
led him to attribute the primary seat of the disease to the bronchial
glands in ten cases, to the hepatic glands in the small omentum
next in point of frequency, then to the lumbar glands, and
lastly, to the cervical and axillary glands in the order named
(*Brit. Med. Journ.*, 1896, Jan. 18th, vol. i.). Hebb (*Trans.
Path. Soc.*, vol. xl., p. 296, 1889) describes a case of primary
lympho-sarcoma of the kidney of a girl aged four.

Lymphadenoma is a growth of tissue closely resembling in
structure that of the lymphatic glands. An overgrowth of lymph-
adenomatous tissue occasionally occurs in organs and parts such
as the kidney, liver, testis and skin, wherein traces only of
such tissue are to be found normally ; as well as in the lymphatic
glands themselves. Lymphadenoma occurs in the kidney in
association with the same affection of other organs. Murchison
and Coupland have put on record in the *Transactions* of the
Pathological Society (vols. xx. and xxviii.) extreme cases of renal
lymphadenoma.

Each kidney may present numerous circumscribed masses of
new growth, round in form, soft in texture, white in colour,
and varying in size from a walnut to a pea. The deposits may
raise the outer surface of the kidney, and also be embedded in
the cortical and pyramidal tissue.

The ureter may be infiltrated, for an inch or two, with an
opaque white material contained in its walls but without occluding
its lumen. The naked eye characters of the growths are not
distinctive, but their microscopical appearances are those of
lymphadenoma : a strongly - marked fibrous reticulum, blending
with the interstitial tissue of the kidney, encloses spaces which
contain nucleated cells ; numerous uniformly small and round
nuclei pervade the substance of the fibrous stroma. In
Murchison's case there are at least a hundred masses shown
in the lateral aspect of one kidney. They were yellowish-white,
looking somewhat like large masses of tubercle, but less apt to
caseate, and harder and closer in texture.

The question arises as to the primary seat of the disease in
these cases. Does it start in the lymphatic glands, in the kidney,

or elsewhere, and thence become generalised ?   Or is there a simultaneous development in different organs and regions of the body ?   The latter would seem to be the case, where many organs are affected nearly equally ; but occasionally the history of the illness may give a clue as to which organ first showed signs of functional disturbance.

I have had a case of this disease under observation in a gentleman, aged seventy-six, who twelve months or more before fell from a bicycle, hurting his left groin in such a manner that, though he could not stand erect or walk immediately afterwards, he was able to mount his machine and ride home two miles, and after a fortnight in bed all ill effects of the fall seemed to have passed off ; but an enlarged, painless, well-defined movable gland appeared some months later in the left groin, others similar in character subsequently developed in the iliac fossa. Till three months before I saw him he had been an active and wonderfully strong man for his age, cycling and taking other forms of vigorous exercise. He was the father of four healthy children, the eldest being under sixteen years of age. The symptoms were rapid loss of strength, marked emaciation, loss of appetite, complete enervation, and slight albuminuria, but an entire absence of hæmaturia and pain. The liver, spleen, retro-peritoneal and mesenteric glands were enlarged, and there was enlargement with induration and slight irregularity of the surface of each kidney. The urine was sometimes very thick from lithates, at others quite clear and of a pale-yellow colour. In Murchison's case the urine was pale, clear, and free from albumen.

Dickinson, under the head of "Leukhæmic Tumours or Extravasations," refers to " white marrow-like tumours, consisting of white blood corpuscles, in a very delicate reticulum, varying in size from a mere dot to a cherry," as having been described as occurring in the kidney in connection with the general condition of leukhæmia.

He adds, " Sometimes the extravasations, though mainly consisting of white corpuscles, present so much the appearance of ordinary hæmorrhage that they are not to be distinguished by the naked eye from such sanguineous outbreaks as have been described in connection with some of the varieties of sarcoma." Dr. Greenfield gives an instance of this in the Pathological Society's *Transactions* (vol. xxix., p. 298, plate xiv.).   In this case a girl,

four and a half years old, died from leucocythemia with multiple hæmorrhages and infiltration of the liver and kidneys.

The kidneys were found enlarged and covered with large purple blotches, and a thin layer of coagulated blood separated the capsule in places from the cortex. Between the hæmorrhagic blotches the intervening tissue was of pale dead-white colour. Similar patches were scattered through the cortical substance, some of which had their bases at the surface of the organ; and around the bases of the pyramids were radiating tracts or bands of hæmorrhage. Microscopically, masses of leucocytes, either in distended capillaries or outside their walls, were found to separate the convoluted tubes; in some places "the tubes were quite isolated, like islands, in a sea of leucocytes. The renal tubules were apparently healthy. There was no sign of stroma or adenoid structure."

Dr. Greenfield briefly summarises the distinctions which are found between lymphadenoma and leucocythemia. He points out that the two diseases differ in etiology, symptoms, duration, prognosis, and the occurrence of hæmorrhages. They are only related in that they both involve the lymphatic and the blood systems; but there is a closer relationship between lymphadenoma and tubercle on the one hand, and cancer and sarcoma on the other, than between lymphadenoma and leucocythemia.

In leucocythemia there is excessive and abnormal production of white blood corpuscles, which stuff the capillaries and transude into the surrounding tissues and give rise to hæmorrhages. The so-called growths are nothing more than collections of leucocytes, without organisation, and no stroma except coagulated fibrin and the normal connective tissue.

In lymphadenoma there is a new growth of an adenoid character composed of a well-marked, sometimes coarse, stroma, and well-formed large and sometimes multinucleated cells.

Rhabdo-myoma or myo-sarcoma.—Cases of renal tumour, of probably congenital origin, and composed of striped muscle and sarcoma tissue, have been occasionally met with, especially in children under two years of age. In some instances there has been a tumour of each kidney; in some, all vestige of normal kidney structure has been destroyed; in others, the tumour has lain beneath the renal capsule upon the surface

of the kidney.* Witzel has recorded a case of a child in which the renal pelvis was greatly dilated by numerous pedunculated tumours of this nature growing from its walls.

These tumours are composed of round and spindle cells; and mixed with them are elongated and transversely striated cells which are usually considered to be muscular elements. These cells vary very much in size and striation, they have no sarcolemma, and their actual muscular origin has been questioned by some; spaces resembling kidney tubules are found in the tumours, and the epithelium lining these may undergo proliferation. Paul and some other pathologists think these tumours belong to the teratomata. In some cases there is a large amount of connective tissue, and it is said that the growths often contain glycogen. Their exact mode of origin is doubtful; it is generally thought that they depend upon the inclusion of muscular tissue during fœtal development. They are regarded by others as being composed of transformed renal elements, in support of which view it may be stated that Eberth † has described a network of smooth muscular fibre on the surface of the kidney; and, more recently, Jardet ‡ demonstrated this tissue in the substance of the gland.

The sarcomata with striated fibres were first described by Eberth. Windle in 1884 § had collected eleven cases, and his paper contained valuable information on primary sarcoma of the kidney. Albarran has added ten to Windle's list. Almost invariably these striped fibres when they occur are met with in sarcomata, but exceptionally they are found in adeno-carcinomata (Hirschfeld). These tumours are often bilateral, often acquire a great size, and frequently remain separated from the renal tissue by a capsule. If secondary tumours form, striped muscular fibres may be found in them also.

On section of these myo-sarcomata, fibrous bands are seen, which divide regularly the sarcomatous mass, and it is in these

* See *Trans. Path. Soc. Lond.*, vol. xxxiii., pp. 312 *et seq.*, for cases by Mr. Eve and Dr. Dawson Williams; *see* also Osler's and Windle's papers in the *Journ. of Anat. and Physiology*, vol. xiv., p. 229, and vol. xviii., p. 160; Paul, *Brit. Med. Journal*, Jan. 12th, 1884; *Med. Press and Circular*, Apl. 30th, 1884; other cases are reported in the *Lancet* Aug. 15th and 29th, 1885.

† Virchow's *Arch.*, Bd. lv., s. 518 (1872).

‡ *Arch. de Phys. Norm. et Pathol.*, Feb. 15th, 1886.

§ *Journal Anat. and Phys.*, vol. xviii., p. 160.

bands that we find muscular fibres, either unstriated or striated; the latter are often imperfectly developed, being devoid of sarcolemma, and it is often difficult to distinguish the one (unstriated) from the other (imperfectly striated).

Adeno-sarcoma occurred in seven out of forty-three cases of sarcomata in children operated upon since 1890.

Alveolar-sarcoma approaches more nearly in structure to carcinoma than the other forms, and is of rapid growth and marked malignancy.

Vale and Manasse speak of endotheliomata, and Manasse and Driessen describe lymphatic endotheliomata. Angeio-sarcoma is less rare than either of these two last-named forms.

Deciduoma malignum.—There is in the Hunterian Museum a kidney affected with this disease, secondary to a deciduoma malignum of the uterus. The growth on section looks like a rounded mass of blood clot partly decolorised in places.

Pathogenesis.—The question *as to the origin* of tumours is still at this day one about which there is much dispute and uncertainty. Tumours of the kidney are no exception to this statement, however well their anatomical forms and their mode of propagation and generalisation may be established.

Malignant tumours begin either in the fibrous stroma of the cortex or in the epithelium of the renal tubes. Frequently, however, the proper tissue of the kidney is invaded by a new growth which has had its primary seat in the lymphatic glands or in some other structure about the hilum; and the disease, putting on the form of the kidney after penetrating the hilum and expanding the capsule, is called a "renal" tumour. Moxon thinks this the commonest plan of attack in primary *malignant disease of the kidney*, and as it may be long before the renal pelvis is penetrated, and as the proper renal tissue remains long intact, we have, he says, the reason of the frequent absence of diseased products in the urine. The whole organ, in time, becomes infiltrated, and when the disease begins within the capsule this process is very rapid, and cysts and bloody or purulent collections form in the organ as the disease advances.

There is commonly a tumour recognisable during life, and if the tissues around the kidney become adherent to the organ, the growth sometimes advances outwards until it is immediately beneath the skin in the loin.

Adenoma and epithelioma.—Different views are entertained as to the origin of renal adenoma and epithelioma. Some consider them as of endothelial origin, others hold that they start from the epithelium of the renal tubules, others from aberrant nodules of adrenal structure enclosed with the renal capsule, whilst Albarran refers the genesis of many of these tumours to aberrant para-renal embryonic tubules.

Robin, Lancereaux, Sabourrin, Sturm, Waldeyer, Sudeck, Depage, Bellatti, and several others regard the epitheliomata as arising from the proliferation of the epithelium of the renal tubules, especially of the convoluted tubes. The starting point of these tumours is generally the cortical area, only exceptionally do they arise from the calyces or renal pelvis. This opinion was expressed by Rayer, and has been corroborated by nearly all observers. De Paoli and Driessen, basing their views on the analogy between these tumours and certain tumours of bones, as well as on the relation of the cells of the tumours to the capillaries, have described the "epitheliomata with clear cells" as endotheliomata, but this view is opposed by the histological characters of the cells and their arrangement or grouping.

Sabourin (1882) regards the isolated adenomata, as well as those met with in Bright's disease, as taking origin in the epithelium of the renal tubules, and considers that cirrhosis of the kidney is the cause of the proliferation of the epithelium. He describes two varieties of adenoma, the cylindrical celled and the cubical celled.

Grawitz (1883) admits that the adenomata with cubical cells (the papillary adenomata) take origin in the renal tubules ; but regards the cylindrical-celled growths (the alveolar adenomata) as well as the epitheliomata with clear cells (strumæ lipomatodes aberratæ renis) as originating in the aberrant masses of the suprarenal capsules included during fœtal life beneath the fibrous capsule of the kidney. He bases his conclusion on the grounds stated on p. 551. Lubarsch in 1894 confirmed the views of Grawitz, basing his opinion on (1) the morphological resemblance previously pointed out by Grawitz ; (2) the form and colour of the cell nucleus of the tumour, which, with the methods of Weigert and Russell, is variously coloured, as also are those of the cortical substance of the adrenals, whilst the cells of epithelioma of the kidney and of other forms of adenoma

fail to show the same effects; (3) the structure of the cellular protoplasm, which contains the fatty globules and the glycogen; (4) the likeness of the tumours affecting the suprarenals to these tumours of the kidney; (5) the presence of giant cells in the tumours like those which occur in simple hypertrophy of the suprarenals; (6) the tendency which these tumours have to penetrate veins, a tendency shared by hyperplastic tumours of the suprarenal capsules. Lubarsch also insists very much on the presence of glycogen, which is constant in the cells of these tumours, but is not found in other new growths of the kidney. Albarran, on the other hand, does not regard the arguments of Grawitz as decisive for the following reasons: (1) The separation of the tumour by a zone of sclerosed renal parenchyma is observed in a great majority of renal tumours, even in those which, like the embryonic sarcomata, arise in the middle of the parenchyma; (2) the presence of glycogen is of slight consequence in all varieties of renal neoplasms; (3) the presence of fatty globules has little value, unless it can be shown that the epitheliomata of the kidney do not possess the same character; and he describes and illustrates a renal tubule, the cells of one part of which have preserved their normal characters, whilst other cells had undergone modifications which made them like to the cells of the tumours under consideration.

These objections, however, refer to only the least important of the points of similarity indicated by Grawitz. Nor is it necessary to reject Grawitz's theory with respect to the pathogenesis of certain tumours, in order to accept a theory somewhat similar etiologically though different morphologically, propounded by Albarran with regard to other tumours. It is impossible to deny that tumours of the kidney do occur which there is every reason to believe arise from the aberrant suprarenal nodules. At the same time we may admit that the great majority of renal epitheliomata spring from the epithelium of the renal tubes, and it can be shown that gradations of changes are traceable from the normal tubes to adenoma and epithelioma. Consistently with this view as to the renal epithelial origin of these tumours Albarran advances the theory of aberrant renal lobules embedded in the capsule of the kidney and capable of degenerating into epithelioma. He has discovered, he tells us, collections of embryonic tubes in the capsule of the kidney. They

occur in the greater number of fœtuses. They represent aberrant formations derived from branchings of the convoluted tubules of the cortex which do not come into relationship with the glomeruli. He thinks that just as paradental epithelial *débris* in cancer of the jaw and the tubular formation of the para-ovary in cancer of the ovary, so these pararenal tubes play an important *rôle* in the pathogenesis of cancer of the kidney. Pilliet, bearing in mind the development of the kidney in two parts—viz. (1) the collecting canals developed from the upper end of the ureter on the one part, and (2) the Malpighian corpuscles and uriniferous tubes on the other, and that subsequently these are joined together—points out that if there is not an equality in number between the collecting tubes and the secreting portions, one or more of these secreting segments not finding an excretory canal will remain functionally isolated within the kidney, and will become the nucleus of an epithelial evolution at a variable period in the development of the individual.

In reference to Albarran's and Pilliet's theories, it is of interest to refer to the results of the experiments by R. Marie,[*] who inserted beneath the renal capsule fragments of the cortical substance of the kidney and found that in two out of twenty-five cases adeno-carcinomatous tissue was produced. In the other twenty-three cases he observed only phenomena of degeneracy more or less rapid, but in no case did the tissue live as a simple graft. These results seem to square very well with the theory of Albarran and with that of Pilliet, both of whom pre-suppose a functional isolation of a portion of renal tissue as a requirement for the formation of a tumour. The pieces of the renal cortex engrafted by Marie were cylindrical in shape. The two animals were killed on the twenty-first and twenty-fifth day after the grafting respectively. In each case a small mass, rather larger in size than the piece engrafted, of an ovoid, not cylindrical form, and of a reddish-grey colour, was seen firmly fixed to the kidney The microscopic examination of these small masses showed identity of structure in the two cases. There were no Malpighian corpuscles, there was nothing characteristic of the tubular structure of the kidney in these living and growing masses of engrafted renal tissue. They were not, indeed, grafts in the proper sense of the word. The only interpretation which their appearances and structure permitted was that they had become adeno-epitheliomatous

* Soc. Anat., Février, 1899, p. 113.

evolutions developed at the expense of fragments of kidney tissue implanted beneath the renal capsule.

The small masses were very similar to the tubular type of adenoma, with small cylindrical or cubical cells. The points of resemblance were their being encapsuled and divided into lobules, and the presence in each lobule of epithelial tubes with dark grey cells of the cylindro-cubical form.

This identity of structure, Marie considers, implies that the process which regulates the spontaneous development of these tumours is analogous with that which led to the formation of the little tumours resulting from his experiments.

If now the various theories which have been propounded to explain the genesis of adenomatous tumours of the kidney are examined by the light of these two experiments, the parasitic theory must be quite rejected, because of the strictly aseptic conditions under which these experimental tumours were produced. The suprarenal capsular theory of Grawitz is clearly not of universal application; whilst Sabourin's theory respecting the formation of adenomata in the course of chronic nephritis requires modification. This last-named theory makes the adenomata an accidental production of renal cirrhosis, and explains them as being developed either at the expense of the convoluted tubes from the granulations formed in Bright's disease, or from tubes contained in the sclerosed areas.

The two conditions shown by the experiments to be necessary are (1) the isolation of a certain number of epithelial elements, and (2) a special vitality of these elements which permits them to resist momentarily the suppression of blood supply and to grow feebly afterwards.

In chronic nephritis certain affected areas become absorbed and are replaced by cicatrices; these cicatrices separate segments of one or many uriniferous systems, isolating them functionally, as was done by Marie's experiments. These isolated portions, he thinks, undergo modifications analogous to those which occurred in the implanted pieces of renal tissue, and more easily so, seeing that the segment in process of being separated from its functional connections by the inflammatory process preserves a certain number of vascular connections, which assure its nutrition, whilst the implanted segments, of course, do not. The conclusions to be drawn from these experimental facts are applicable, Marie thinks,

not only to adenomata of the kidney, but also to epitheliomata of the kidney and to cancer in general.   The facts themselves not only tend to make us reject the parasitic origin of tumours, but to regard these tumours as an individualisation of certain fragments of tissues or organs, and as a deviation more or less accentuated from their original type of structure.

Sarcoma is developed in adults in connection with the renal capsule and from the interstitial connective tissue of the kidney.   As unstriped muscle fibres are contained in the renal capsule, and renal pelvis and calyces which are continuous with the capsule, and are met with in the connective tissue of the parenchyma (Jardet and Albarran), it is easy to understand that similar muscular fibres are found in some of the renal sarcomata. But primary tumours of the kidney are also met with which contain striated muscular fibres or cartilage cells, structures which do not normally exist in the kidney, and their presence is only to be explained by supposing these elements to proceed from the embryonic inclusion of neighbouring tissues beneath the capsule of the kidney.   It is possible that aberrant renal nodules play an active *rôle* in the development of the adeno-sarcomata (Albarran).

Sarcoma begins sometimes outside the renal capsule in the perinephric tissue, sometimes (and commonly in children) in the cellular tissue of the hilum, and after increasing to a variable size, spreads into and distends or otherwise involves the substance of the kidney.   A large sarcoma invading the renal pelvis is seen in Fig. 90.   In Fig. 78 (p. 548), a round and oval-celled sarcoma invaded or commenced in the wall of a large renal cyst, without affecting the renal parenchyma at all.

Symptoms.—It is important, from the point of view of treatment, that a malignant tumour of the kidney should be recognised as soon as possible.   It should be borne in mind that nephrectomy for cancer or sarcoma of the kidney is the more hopeful and efficacious the sooner it is performed after the first onset of the disease.   Thus it is essential, in the interest of the patient, for us to know what are the first symptoms by which these tumours make themselves manifest.

There are three leading symptoms which require examination, namely, hæmorrhage, tumour, and pain : besides these there are two others of some importance when they exist, though they are

not always or even generally present—namely, modifications in the characters of the urine, and varicocele.

Hæmaturia.—Hæmaturia is not seldom noticed before the detection of a tumour ; in some cases it is slight or altogether absent ; in others it is severe. Long, recently formed blood-clots may be passed *per urethram*, as in the remarkable case mentioned on p. 9, Vol. II. Sometimes clots of blood partially block the ureter for a time, and then, after all the colouring matter has

Fig. 90.—Sarcoma invading Renal Pelvis.
(Guy's Hospital, No. 1663.)

been washed out of them, are passed *per urethram* as colourless fibrinous shreds or columns. Hæmaturia occurs as the first symptom in at least 50 per cent. of all cases of malignant tumour in the adult ; but tumours which commence in the hilum or just beneath the renal capsule, or deeper in the cortical or even in the pyramidal parts of the kidney, without early affecting the papillæ, calyces or renal pelvis, may cause a tumour before producing hæmaturia.
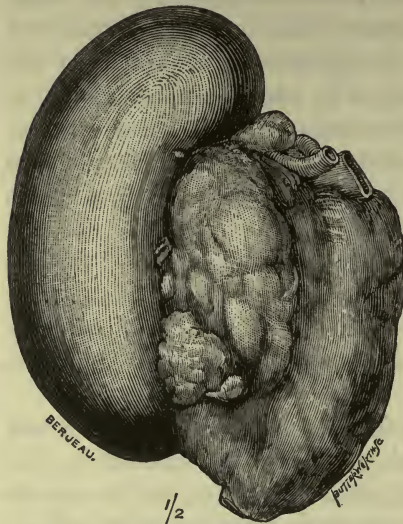
Denaclara,* in a collection of 409 instances of new growth of the kidney, of which 168 were patients of adult age, found that hæmaturia was the first symptom in 68·88 per cent. of the adult cases. The hæmaturia occurs spontaneously, without obvious cause, often without pain, and in a way unexpected. Suddenly the patient finds that he is passing blood with his urine without any premonitory or accompanying symptoms. It is often abundant ; it is sometimes recurrent at longer or shorter intervals — intervals of days, weeks, months, or even years—leaving the patient quite free from bleeding in the intervals. In some cases it is uninterrupted, lasting days or weeks persistently, causing extreme anæmia by its continuance ; in other cases it is both abundant and persistent, threatening the life of the patient and demanding urgent surgical interference.

* *Thèse de Lyon*, 1899 : "Des Hématuries dans les Néoplasmes du Rein."

Hæmaturia, according to Guillet, (1) is often spontaneous ; (2) is not influenced · by repose or exertion ; (3) occurs at any period of the disease ; (4) is repeated at variable intervals ; (5) is usually profuse ; (6) lasts from one to six days and may subside completely, to recur in a few hours ; (7) is often preceded by pain. The blood is intimately mixed with urine, but may be accompanied by clots.

The question occurs, to what cause is hæmaturia in tumour of the kidney directly due ? It is no doubt owing to congestion, caused by the pressure of the tumour on the parenchyma in the early stages, and to congestion or to ulceration into the renal calyces or renal tubules in the later stages. Malignant tumours are very vascular and of soft consistence, so that they readily give way, as shown by the frequency of interstitial hæmorrhages into them.

Denaclara's figures show that in adults hæmaturia occurs most frequently between the ages of forty and seventy. No instance of new growth of the kidney was met with between ten and eighteen years.

Hæmaturia preceded the appearance of tumour in forty-six cases, and there were six in which it was apparently induced by violence. In one case the interval between the occurrence of hæmaturia and the recognition of the tumour was so long as fifteen years, and in another seven.

Thirty-one instances of hæmaturia were associated with malig-nant growths. In six cases the hæmaturia and tumour were noted simultaneously.

Hæmaturia was the only indication of disease in twenty-three cases, of which nine were benign growths. Lumbar pain without distinctive character accompanied the blood in fifteen of the patients. In six others the pain resembled renal colic, and in five it was preceded by retention of urine. The growth was not recognisable during life in six of the cases. In forty-one cases, hæmaturia was the only symptom of the neoplasm, having been in one instance associated with pains which were not dis-tinctive, and in one with pseudo-colic.

Of the entire series in which hæmaturia occurred, namely, in 109 out of 168 cases of new growths of the kidney, movement and repose had no influence in determining the occurrence except in two. In all the others, hæmaturia was spontaneous

both in its commencement and cessation, whatever the mode of life of the patient. It was only continuous in seven cases; intermittent for the most part, with short intervals in five instances, and very long ones in three others. . Ten patients suffering from regular attacks at the commencement noticed the intervals becoming shorter and shorter as the growth developed. Nine others, on the contrary, who commenced with frequent attacks, observed a gradual diminution till they ceased altogether.

The quantity of blood lost was considerable throughout the disease in twenty-three patients. In three, though copious at first, the hæmorrhages amounted to little in subsequent attacks, in seven others it was in small amount throughout, and in one it was only recognisable by the microscope.

In all the observations the blood was uniformly mixed with the urine, except in one case in which it occurred only at the commencement of micturition. The presence in the urine of moulded or worm-like clots was noticed eight times.

In children forty-six malignant and thirty-three benign tumours were not associated with hæmaturia; nineteen malignant and ten benign tumours were so associated. In the other collected cases the nature of the neoplasms was not indicated. Thus there was hæmorrhage in a percentage of 41·3 of the malignant tumours, and in 30·3 per cent. of the benign tumours.

In some instances the absence of hæmorrhage would seem to be rather apparent than real, as for example in a case of rapidly growing cancer reported by Brault,* in which the absence of hæmaturia was accounted for by contraction of the kidney on itself through cancerous adhesions to the vertebral column —the renal pelvis being rendered impermeable.

In adults, ninety malignant and forty-three benign tumours presented no hæmaturia, whilst hæmaturia occurred in sixty-eight malignant (75·5 per cent.) and twenty-four benign (55·8 per cent.) tumours.

Tumour.—In twenty-three per cent. of cases in the adult, a tumour was the first discoverable symptom. In the adult the tumour caused by malignant disease is neither so early nor so frequent, nor so easily made out, as in children. It has in adults to be carefully sought for; the patient is usually in ignorance of its existence, and complains commonly only of a certain

* *La Semaine Méd.*, ii., 1891, p. 249.

degree of weight or dragging in the lumbar region. In many
instances the tumour has been merely a nodule of new growth
in the kidney substance, not exceeding in size a walnut or a large
cob nut; palpation therefore ought to be practised with the most
minute care and thoroughness. It is only after a long experience
in palpation of the kidneys that one is able to detect tumours
of small or medium size within the renal capsule. It is too
frequently the case, therefore, that malignant renal tumours are
only discovered when they have attained a size large enough
to form evident tumours, and when it is too late to perform
nephrectomy; or if not entirely too late, still at a stage when
the operation becomes much more hazardous and the ultimate
result much more unpromising.

The character of the tumour formed by enlargement of the
kidney has been described in Chapter XVIII., p. 531.

The presence of a tumour in the loin is, at some time in the
development of the case, almost a constant feature; although,
as already stated, it is not always the first indication, and is not
nearly so common in adults as in children. It is soonest apparent
when the enlargement is general or at the lower pole, or when
the kidney through undue mobility can be brought readily within
reach of palpation below the costal margin. On the other hand,
when the upper extremity is affected or the kidney fixed high
up, the swelling may only be appreciated after it has attained
considerable size. No protrusion in the loin or noticeable asym-
metry is to be expected with a growth of small or even moderate
dimensions. Sometimes there is a degree of dilatation of the veins in
immediate neighbourhood, indicating embarrassment of the deeper
circulation. The tumour is only appreciable by careful palpation
and is to be detected by bimanual examination or *ballottement*,
that is by being pressed backwards and forwards between the
hands placed below the costal margins. With ordinary mobility
it can be felt to descend in inspiration on palpating in the manner
previously described (*see* pp. 84, 85). The mass occupies the flank
between the costal margin and the anterior superior spine of the
ilium, and when fairly defined the colon can be felt between it and
the abdominal wall; allowance however must be made for variations
between contraction to a thick cord and great distension with
fæcal matter or gas. The tumour is, as a rule, painless until by
its increased dimensions it exercises severe pressure on surrounding

structures ; then it may become severe, paroxysmal, and radiating. It is not usually very tender, as is the case with inflammatory swellings, and unlike them is smooth, well defined, and sometimes pulsating. Percussion anteriorly yields a resonant note and posteriorly a dull one extending to the vertebral column. The facility with which the tumour may be detected varies considerably with the thickness and tension of the abdominal wall, and in difficult cases is much increased by anæsthesia. The growth is as a rule rapid, but cases occasionally occur where symptoms have been apparent for some years.*

Œdema, constipation, vomiting, and jaundice (when the right kidney is affected) may be present ; the last named being due to obsruction of the common bile-duct. †

Guillet has divided the growth of the tumour into three stages : (1) when it is but little developed and passes undetected, unless very carefully searched for by bimanual palpation. Guyon points out that by means of renal *ballottement* the diagnosis of renal tumour can sometimes be made before the appearance of any other symptom. (2) When the tumour, having acquired a moderate size, makes an appreciable prominence at the level of one of the antero-lateral regions of the abdomen. It is then discoverable on deep palpation as well as by renal *ballottement*. There is generally resonance in front, unless the colon is empty, and then the collapsed bowel can be rolled under the fingers upon its surface. (3) When the tumour occupies a large part of the abdomen ; when it loses some of its peculiar characters, when *ballottement* is no longer possible, and palpation and percussion no longer give clear indications as to its connections.

Pain.—Pain is often absent in children ; it was found to be the first symptom in 35 per cent. of adult cases in which the clinical details are sufficiently fully and clearly given. Slight at first, it has the following characters as soon as it definitely attacks the patient. It is situated in the lumbar region and thence radiates to the thorax, where it takes the form of intercostal neuralgia, or towards the thighs, genitals, and abdomen. The pain is spontaneous, uninfluenced by rest or movement, occurring by night as much as by day. It is not generally severe and is often intermittent ; still, in some exceptional cases it has been

* *Bull. de la Soc. Anat.*, 1889 ; *Rev. de Méd.*, 1893, p. 727.
† G. Aberden, *Brit. Med. Journ.*, May 13th 1876.

agonising and continuous. In Brault's * case of this painful form of cancer of the kidney, death was induced by the exhaustion caused by the sufferings.

We have no information as to the relation between the first date of occurrence, or the degree of intensity of pain, and the degree of development of the tumour. The pain is no doubt sometimes due to pressure of the growth or of the secondary glandular enlargements upon the nerve filaments in its neighbourhood; in other cases it is caused by the vascular congestion of the organ compressed within its capsule; in others by occlusion of the ureter by blood-clot or a fragment of the tumour; † in others, again, the pains are of the form of nephritic colic due to the transit of a mass of clot along the ureter. In all cases where the cellulo-adipose region around the kidney has been infiltrated, pain occurs from involvement of nerves or extension of growth to the spinal nerve roots; but in the earlier stages of the disease there may not be sufficient disturbance of sensation to indicate the side affected. The occurrence of pain together with increase in the size of the tumour alternating with hæmaturia is of importance from a diagnostic point, indicating as it does a condition of intermitent uro-hæmato-nephrosis. When the pains are caused by the pressure of the tumour or of lymphatic glands secondarily invaded they must be looked upon as a late sign. There is, however, nothing special about the character of the pain of malignant tumour, neither is it constant or characteristic.

Modifications in the quantity and characters of the urine.— As a rule the urine offers no indication of the nature or even of the presence of a tumour, nor is the quantity of urine altered. In other cases, however, at the commencement of a malignant growth of the kidney, the quantity of the urine is sometimes increased (polyuria), sometimes diminished (oliguria), or even temporary stoppage of secretion may occur. The amount of urea is sometimes markedly diminished, and this has in some cases been in itself sufficient to draw attention to the early existence of cancer of the kidney (Rovsing). In many cases, however, the amount of urea is quite uninterfered with. By microscopical examination blood corpuscles (microscopic hæmaturia) have been sometimes discovered long before there has been

* *La Semaine Méd.*, ii., 1891, p. 249.

† *See* case reported by Dr. Leared, *Path. Soc. Trans.*, vol. xxi., p. 252.

naked - eye evidence of blood. Cancerous particles have been
in rare instances discovered, as in the cases of Bonet, Segerus,
and G. Little reported in the *Dublin Journal of Medical Science*
for January, 1873. In other cases pieces of villous growth or
sarcomatous tissue or calcareous masses have been found. The
colour of the urine is normal or not, according to the presence
or the amount of blood in it. Pus will rarely be found, it only
occurs if there is pyelitis or pyelo-nephritis. The chlorides and
acid phosphates are sometimes diminished. The presence of
albumen is not constant; its occurrence and amount are in
relation to the presence of blood or pus or of a certain degree of
congestion of the affected kidney; or to an alteration in the
epithelium of the opposite kidney.

Cancer of the kidney, like cancer of the bladder, may cause
frequent micturition. Sometimes, when the kidney alone is involved,
the irritability of the bladder is so great that the nephritic
mischief is overlooked, and primary cancer of the bladder, or
vesical calculus is supposed to exist, as in a case recorded by
Milner Moore in the *Lancet* (vol. i., p. 770, 1879).

Varicocele.— When, in 1884, I wrote my former work on
the "Surgery of the Kidney" I drew special attention (p. 488)
to a varicocele which had appeared and gradually increased with
the growth of a left suprarenal malignant tumour. I have
since seen varicocele in association with an epithelial cancer of
the right kidney, which completely disappeared on the second
day after nephrectomy. I did not know till long afterwards
that M. Guyon had, in 1881, described this as an occasional
symptom of malignant renal tumours. Guyon taught that the
existence of a varicocele of relatively recent date ought always
to lead us to examine the renal region of the same side, and
he tells of a case in which a young musician was about to undergo
at the hands of a distinguished surgeon an operation for painful
varicocele before the examination of the corresponding flank
(left) led Guyon to the discovery of a left renal tumour. Guyon
is of opinion that varicocele is a very common consequence of
renal malignant tumour, but that it escapes notice owing to
patients being for the most part examined when lying down.
My own experience, however, leads me to regard varicocele as
quite an exceptional though, when it exists, an important symptom.

The characters of this varicocele are the following : it may

be situated on either the right or left side, depending on the side of the renal tumour, its appearance is comparatively sudden, it occurs in persons beyond the ordinary age for varicocele, its progress is rapid and marches with the growth of the renal tumour, and finally it rapidly subsides after removal of the tumour by nephrectomy. It may occur as an early symptom before the tumour has attained a large size.

An important question regarding this varicocele from the point of view of its being a guide to the surgical treatment is as to the cause of its occurrence with malignant tumour. Is it due to compression of the spermatic veins by the renal tumour itself or by enlarged secondarily affected lymphatic glands ? M. Legueu, who in 1895 wrote a paper on the subject,* considers it due to pressure by enlarged lymphatic glands on the spermatic vein at its entrance into the renal vein on the left side and into the vena cava on the right. If this be so varicocele would contra-indicate nephrectomy, because it would indicate enlarged secondarily invaded lymphatic glands. But it can be shown (1) that varicocele occurs in cases in which the glands are not enlarged (Boinnet, Le Dentu, Israel); (2) that varicocele does not occur in all cases in which the glands at the hilum of the kidney are much enlarged; and (3) that even where varicocele has been present with enlarged glands the glands have not pressed upon the orifice of the spermatic vein but the renal vein has been blocked by blood-clot. Morestin (quoted by Heresco) had a case in which a varicocele was caused by a large tumour of the right suprarenal capsule without any glandular enlargement, and which had disappeared six weeks after the removal of the tumour. This case is a striking proof of the independence of varicocele and glandular infiltration. From our present knowledge it is impossible to agree with Legueu that symptomatic varicocele is caused in all cases by pressure of the spermatic vein by the enlarged lymphatic glands. It is sometimes due to that cause no doubt, sometimes to pressure on the spermatic vein by the tumour itself, and sometimes on the left side not to either of these causes but to blockage of the renal vein by blood-clot or extension of sarcomatous tissue along the renal vein. It cannot therefore be regarded as a contra-indication of

* "Le Varicocèle Symptomatique des Tumeurs Malignes du Rein," *Presse Médicale*, Août, 1895, p. 321.

nephrectomy.   In this form of varicocele the veins do not present
any marked thickening of their walls.

The *general symptoms* of malignant tumour of the kidney—
wasting, anæmia and cachexia—accompany the development of
cancer in the kidney, as elsewhere.   But these new growths, whether
sarcomatous or epitheliomatous, may exist a long while without
giving rise to symptoms dependent on impairment of the general
health.   Such tumours are known to have existed two, three, or
more years without the bearers of them showing any sign of the
hopeless disease by which they were being gradually borne to
their graves.   The digestive functions, the appetite, and the regular
action of the bowels may all remain good.   But when the general
health becomes affected complete loss of appetite, great weakness,
and rapid emaciation soon bring about the condition often spoken
of as the cachexia of cancer.

In rare cases emaciation has been the earliest symptom to
lead to the discovery of malignant renal tumour (Guillet) ;   and
when this condition is present, and is otherwise unexplained,
the kidney as well as other organs should always be examined.

There are a few cases in which the first sign of malignant
disease of the kidney is the so-called cachexia.   They have been
described as latent cancer.   Secondary growths in distant parts .
have occasionally been the first indication.   Thus Curtis related a
case in which metastases in the bones occurred before any other
symptom.   Hawthorne, Villaret, Stroup, and Tuffier record
somewhat analogous cases.

Israel has recorded a case in which hectic fever of several
months' duration, vomiting and nausea, and emaciation were
associated with a large renal tumour.   All symptoms for a time
ceased after nephrectomy ; but recurrence soon took place, and
was attended by the same symptoms—fever, nausea, vomiting—
which clearly showed the dependence of these symptoms on the
malignant affection of the kidney.   This is spoken of as a toxic
form of renal sarcoma.

Sarcoma and carcinoma have many clinical symptoms in
common, but some differences.   In sarcoma hæmaturia is not so
common as in carcinoma, but is more profuse.   Metastasis, like-
wise, is rare.   Cachexia does not develop early, partly, no doubt,
owing to the absence of these two factors, and the general progress
of the disease is slow, extending over five or six years.   Tumour

and pain are prominent symptoms of sarcoma in adults. As is common in carcinoma, pain and hæmorrhage occur spontaneously ; tenderness is not a common feature in connection with the tumour, but may occur from time to time without evident cause. In sarcoma pressure symptoms develop early, and owing to the great bulk attained by the tumour, are ultimately more marked than in carcinoma.

The urinary changes, if any exist, are much the same in both. The duration of cancer in the adult, though shorter than that of sarcoma, is long compared with the course of the same disease in other viscera, averaging two and a half years, and sometimes extending to six years.

When only a single kidney exists the course of the disease is necessarily shortened, as in cases reported by Wood in the *New York Medical Record* (1886), and by Manby in the *Lancet* (1885).

The following comparative table is given by Guillet :—

CARCINOMA.		SARCOMA.	
		Adult.	Infant.
Age . . .	40 to 60 years	20 to 40 years	5 years.
Hæmaturia .	Profuse in two-thirds of the cases	In a small fraction of cases, profuse	In two-thirds of the cases but slight.
Pain . . .	Usually great pain	Usually great pain	Often absent.
Cachexia . .	Present early	Absent for a long time	Early.
Duration . .	3 to $3\frac{1}{2}$ years	5 to 6 years or less	Less than one year.
Generalisation	Usually occurs	Occurs only in a few cases	Occurs only in a few cases.

Diagnosis.—The diagnosis has to be made, first, as to the seat of the tumour ; secondly, as to its precise nature.

Diagnosis as to the situation of the new growth.— The exact locality of the tumour when first seen, its direction of increase, and the line of surrounding dulness or resonance on percussion, will help to fix the renal origin of the swelling, as distinct from an origin in the liver, spleen, or ovary. But errors in this respect are sometimes unavoidable, and I have found, on post-mortem examination, a large cancer in the kidney of a man who had been supposed to be the subject of malignant disease of the liver. Similar errors as to the spleen, when the left kidney has been the seat of a cancer, are on record. Other renal enlargements as well as malignant renal neoplasms give

rise to the same mistake. Thus I have twice operated upon large calculous pyo-nephrotic kidneys, which had been diagnosed by physicians and treated for months, one as cancer of the liver, the other as a "cancerous tumour either of the spleen or kidney." The rapidity of growth of the tumour, its unequal resistance and nodular outline, and the progressively cachectic aspect of the patient point to cancer; and when a swelling which begins on one side of the abdomen and in the renal region of a patient either below the age of five or over that of forty years attains rapidly a very large size, its malignant nature may be diagnosed with fair certainty.

Whether in children or adults, it is no uncommon thing for these tumours to reach a weight of eight or nine pounds; sometimes they attain to thirty or forty pounds.

From enlarged mesenteric glands renal cancer is distinguished by its one-sided position and less nodular outline; from cancer of the colon or small intestine by the absence of characteristic intestinal symptoms. The reader is referred to p. 538 *et seq.* for the points of difference between renal tumours and other abdominal enlargements, and for the account of the diagnosis of renal tumours in general.

We have now to indicate how renal **malignant tumours** are to be diagnosed from other forms of renal swellings, and how malignant disease of the kidney is to be diagnosed when there is no tumour. It has been stated above that hæmaturia, tumour, and pain are the three chief symptoms of renal malignant new growth or renal "cancer," if we use the term "cancer" clinically to include all forms of malignant disease of the kidney. We now want to ascertain whether one or other of these cardinal symptoms, when present alone or together, is due to "cancer" or to some other renal disease. When hæmaturia and tumour co-exist the presumption is that the tumour is renal. It may not be so, however, because the two symptoms may co-exist and not be due to a common cause; and even when the tumour by its own characters points to kidney, we have yet to make sure that it and the hæmaturia are caused by renal cancer, and not by some other renal affection.

At its onset "cancer" of the kidney presents symptoms common to it and to other renal affections, such as renal tuberculosis, renal calculus, pyo-nephrosis, hydro-nephrosis, and to what is called "essential" hæmaturia.

It is very difficult indeed to diagnose from early "cancer" these several affections when they themselves are at a stage insufficiently advanced for a clear diagnosis to be made of them.

When hæmaturia such as we have described above and an easily ascertainable renal tumour exist together the diagnosis of "cancer" of the kidney is highly probable, and is made more so if, the hæmaturia being intermittent, clear normal urine or urine with a diminished amount of urea is passed in the intervals. With a renal tumour without change in the urine, or with a lessening amount of urea as the only deviation from the normal, cancer is the probable diagnosis in the adult between forty and seventy, or in the child below ten.

When there is hæmaturia without tumour.—The difficulties in diagnosis, however, become very great when hæmaturia occurs with pain, but without tumour; and they are still further increased when hæmaturia occurs alone, without either tumour, pain, or recent varicocele.

In this last condition (hæmaturia as an only symptom) we have first to localise the source of the hæmorrhage: (1) that it is renal; (2) that it comes from one kidney, and not from the other; and (3) to pass in review all the various causes of renal hæmorrhage, and take into consideration the characters of the hæmaturia, and any other symptom which the patient presents, before deciding that the renal affection is "cancer," and not some other form of renal disease.

1. The diagnosis as to the renal source of the hæmaturia is based upon the following features: — (a) the blood is thoroughly mixed with the urine throughout, not terminal or chiefly at the end of the act, so that the first urine passed is as equally loaded with blood as the last few drops. This sign is not, however, absolutely pathognomonic or quite invariable, because in very exceptional cases when the blood comes from the bladder it is uniformly mixed with the urine; and conversely in renal hæmaturia the deepest coloured urine, or even pure blood, may come at the end of the act of micturition, if the kidney bleeds so profusely that the blood flows freely from it whilst micturition is proceeding. But these are exceptions, not only as to the cases in which they occur, but as to the particular acts of micturition in the same individual. (b) A second character of renal hæmaturia is the passage of worm-

like blood-clots, partially decolorised, which the patients some-
times bring to the surgeon thinking they are really lumbrical
worms ; in other cases, as Hilton years ago was in the habit of
showing to his pupils, the blood - clots instead of taking the
mould of the ureter, take that of one or other of the calyces.
In most cases in which renal or ureteral blood-clots are voided
heir transit along the ureter excites pain or actual colic, and this
gives the indication as to the particular organ which bleeds.

2. The diagnosis of the side from which the renal hæmorrhage
proceeds is generally determined by clinical signs of some kind,
but if not it may in some cases be ascertained by the cystoscope.
Constant or profuse hæmorrhage, or an irritable state of the
bladder, or an enlarged prostate may, however, render cystoscopic
inspection of the ureteral orifices unsatisfactory or impossible.

3. The diagnosis of the nature of the renal disease which is
causing the hæmaturia is often very difficult. Is it cancer,
is it calculus, or is it tubercle ?   Or is it due to still some other
cause than these ?   The characters of the hæmaturia in malig-
nant renal disease are described on p. 576.

The hæmaturia of **renal calculus** is provoked by exercise
or movement, and is diminished or ceases with rest.   It is not
usually of long duration, and ceases within a few hours under
the influence of rest ; but it is sometimes abundant, and may
continue in spite of absolute quietude.   If it ceases with rest, it
may recur after the least movement.   I have known a walk of a
few steps from the bed to the sofa, after complete confinement to
bed for two weeks, bring it on again.

The hæmaturia caused by a stone passing along the ureter
generally follows nephritic colic.   In rare cases it precedes the colic.

With renal calculus, equally with renal cancer, we find
hæmaturia with or without tumour, with or without pain ; but
it is the common thing to have pain as well as hæmaturia,
though tumour is a comparatively rare occurrence in renal cal-
culous affections, unless hydro-nephrosis, pyelitis, or pyo-nephrosis
also exists.   In renal calculus the kidney is often tender, and
there is frequently history of lithiasis and hæmaturia of years ago.
There are many cases on record to show that long-standing
renal calculus is a precursor of carcinoma, but with the super-
addition of carcinoma the characters of the hæmaturia change.

The features of the hæmaturia of **tuberculous kidney,** as

a rule, are the following. It is spontaneous, small in amount, intermittent, uninfluenced by movement or rest, and repeated at short intervals. In rarer cases renal tuberculosis, especially the miliary form, has excited a hæmaturia, sudden in its onset, profuse in quantity, and persistent for weeks together. Even with these characters it is impossible to be sure that the hæmaturia is due to tubercle, and not to " cancer " of the kidney, unless we find the bacilli of Koch in the urine or evidence of tubercle in some other organ. Even if there is a tumour, our diagnosis may still remain uncertain or prove to be erroneous. Albarran has recorded the case of a female patient with hæmaturia which had all the characters of renal new growth. A small nodule the size of a nut was found in the right kidney, and this on microscopic examination was ascertained to be a tuberculous nodule, not a cancer. Conversely, Newman * records a case in which the functional and physical signs suggested tubercle, but the autopsy showed the disease to be cancer.

In a case of a very large tumour under my care the hæmaturia, pyuria, and other physical signs, the fever and the emaciation, as well also as the appearances during the operation of nephrectomy, pointed to tuberculous pyo-nephrosis with extensive deposits of tubercle in the cortical substance of the kidney; but the microscopic examination showed the condition to be a breaking-down cystic epithelioma. Recurrence took place within three months, and the patient was dead within four months of the operation, and nineteen months after the first discovery of a tumour. In another and more recent case in my wards at the Middlesex Hospital the appearances of the large kidney after removal were just those of tuberculous disease; but microscopical examination showed it to be cancer, and the man died with secondary growth in his brain within three months after the operation.

In renal tuberculosis there will usually be pyuria, and in the intervals between the hæmaturia the urine is turbid; it may also contain the bacilli of tubercle. It must be remembered, however, that tuberculosis limited to the cortical part of the kidney may give rise to irregular, intermittent, apparently unprovoked hæmaturia without any other change in the urine. We must look, then, to the age, the family and personal history, and the state of the other organs of the patient to aid us in

* *Glasgow Med. Journ.*, 1896, p. 179, case 2.

forming a diagnosis. If with hæmaturia without pyuria there is a renal tumour, tubercle is improbable, and cancer most likely exists. If with hæmaturia and pyuria there is a tumour, and if there is also fever, then tuberculous pyo-nephrosis becomes more probable than malignant disease ; though it might be cancer, as in the case just referred to proves.

Other diseased conditions besides cancer, calculus, and tubercle give rise to hæmaturia ; it is also met with after slight injuries, thrombus or embolus in the renal vessels, and even in the absence of any lesion whatever of the kidney. Hæmaturia in **chronic nephritis** presents in certain cases all the characters of hæmaturia from renal tumour. Very abundant one-sided renal hæmaturia may continue for days or weeks in subacute and chronic nephritis, whether of the form of Bright's disease or following disease of some other kind, such as influenza or pneumonia. I have known severe hæmaturia occur as an early symptom in subacute nephritis induced by a repetition of exposure to damp and cold. The source of the bleeding was at first supposed by the medical attendant to be the bladder, and the cause to be vesical calculus, until it was pointed out that there was more albumen than even the blood explained and that the urine teemed with renal casts. Partial suppression soon ensued, and the patient died within three months from uræmia. It is by the presence of albumen and renal casts either constantly or on some occasions only, and in the intervals between the hæmaturia when this is intermittent, that the diagnosis of chronic or subacute nephritis will be made. If, however, when the urine is clear of blood it does not present any other abnormality the diagnosis is most difficult. When nephrotomy is had recourse to in these cases the kidney presents signs which indicate the nature of the case—it is puckered, scarred and mottled in colour ; in detaching it for examination we find it irregularly and more or less toughly adherent to the surrounding tissue in places, and on section some parts of its parenchyma look pale yellow, whilst for the most part it is deeply congested, and the knife meets with different degrees of resistance, indicating that in some places it is much harder and denser than elsewhere. Nephrectomy should never be resorted to in these cases, as the other kidney may be or may become similarly changed, and more especially as simple exploratory nephrotomy has in several cases been followed by cessation of the hæmaturia.

There are a certain number of cases of renal hæmaturia without ascertainable renal lesion, the so-called *essential hæmaturia*, which at present are unexplained; cases in which the hæmorrhage is so profuse, so unprovoked, so recurrent or persistent, that no amount of rest, and no remedies which have been tried have influenced it; and in which no explanation is forthcoming even after a post-mortem examination. The hæmorrhage in some of these cases probably depends upon some functional derangement or actual lesion of the vaso-motor nervous system, in others possibly upon a morbid condition of the blood or blood vessels due to some toxic cause.

I have known at least three fatal cases of the sort, two after nephrotomy, and one in which no operation was performed. In the first case* upon which I operated the patient was a young man of twenty, who for six months had suffered from severe attacks of hæmaturia uninfluenced by exercise or rest, but attended with pain in the loins, chiefly in the right loin. The repeated and considerable losses of blood had rendered him very anæmic, weak and emaciated, and his condition was becoming progressively worse. The right kidney was cut into and thoroughly examined, with negative result; nothing was found to explain the hæmaturia, and no improvement in the symptoms resulted. Ten days after the nephrotomy I performed nephrectomy, because of the continuing hæmaturia and the supervention of hæmorrhage from the kidney operated upon. Hæmaturia, however, continued after the nephrectomy, and the patient died the next day. There was nothing in the naked-eye appearances of the kidney removed, or of the left• kidney, or of the bladder, or any part of the urinary system to explain the cause of the hæmorrhage. Neither a microscopic nor a bacteriological examination of the kidneys was, I regret to say, made, their naked-eye appearances being so normal that further examination was unfortunately omitted. In the second case operated upon for similar symptoms there were no naked-eye or *microscopical* characters existing to account for the symptoms.

The essential hæmaturia of hot or tropical countries is caused by parasites, such as the bilharzia or filaria or the plasmodium malariæ; in the colder countries neither parasites in the blood or urinary organs nor any lesion of the kidney is discoverable.

* "Hunterian Lectures," Table IV., No. 30, and Table VIII., No. 3.

Some of the German authors, following Senator and Klemperer, describe cases of "essential" renal hæmaturia under the name of "angeio-neurotic," and to this class I believe the two cases I have referred to belong. Schede, Klemperer, Nitze, Debaisieux, and others have reported cases of the sort for which nephrotomy or nephrectomy has been performed. Nitze speaks of having operated in seven cases of "essential" hæmaturia—four by nephrectomy and three by renal incision. In Schede's case the hæmaturia had lasted many weeks, and the kidney after nephrectomy was microscopically examined and found to be quite healthy.*

Though the clinical diagnosis of these cases is impossible, yet when there is any indication as to which kidney is the source of the hæmorrhage we have exploratory nephrotomy to fall back upon. It is satisfactory to learn that in a good many cases of undiagnosable hæmaturia which have been operated upon the hæmaturia has ceased and has not recurred. The explanation of this is possibly the removal of intra-capsule tension by the relief of renal congestion, whether due to blood or nervous cause in the first place. It is, however, difficult to understand why, though the bleeding ceases for a time, it does not in all these cases recur after the kidney is healed. In neither of the cases upon which I performed nephrotomy, was the bleeding controlled by the operation. In one case in which (in March, 1896) I performed simultaneously nephrotomy and nephropexy for hæmaturia associated with hæmato-nephrosis in a movable kidney, the hæmaturia did not cease till some weeks after the nephrotomy, and then after an interval of more than a year, the kidney being well fixed, recurred to a less degree, and has done so two or three times subsequently. In another case in which I performed nephrotomy for hæmato-nephrosis and hæmaturia there were subsequent recurrences of hæmaturia for a time until the kidney atrophied; and at the patient's death, fourteen months after the operation, retro-peritoneal carcinoma, unconnected with the atrophied kidney, together with secondary deposits in the liver, were found. There was no tumour to be discovered, though often sought for during life.

In some of the cases of the so-called essential or angeio-neurotic kind there is reason to think the hæmorrhage comes from both kidneys, even when there is some other local symptom such as

* *See* also Harris, *Med. Journ. Philadelphia*, March 19, 1898, on cases of *Essential Hæmaturia*.

pain or nephrectasis pointing to one kidney rather than to the other.   This clearly was so in the fatal case upon which I operated, and to which I have referred above.

Nephralgic hæmaturia.—Since the time of Sydenham much has been written and many cases have been published to show that renal neuralgia gives rise to hæmaturia in the absence of any appreciable lesion of the kidney.   Many cases of nephralgia are attributed to malarial poisoning.   Tiffany of Maryland speaks of having seen a number of cases of malarial hæmaturia in which there was apparently no history of intermittent or remittent fever.   He seems to have gone some way towards proving the malarial origin of the hæmaturia and pigmented urine in some of these cases by finding the plasmodium malariæ in the blood. Maurice Raynaud, Rolf, Legueu, Broca, Sabatier, and others have attributed hæmaturia to nerve causes. Nephralgic hæmaturia has been ascribed to a profound disturbance of the vaso-motor system of the kidney, just as symmetrical gangrene is ascribed to exaggerated vaso-motor disturbance in the fingers and toes and other peripheral parts in Raynaud's disease.

In many of the cases, however, some other condition, such as oxaluria, lithæmia, movable kidney, and chronic nephritis, has been present by which possibly both the pain and the hæmaturia may have been caused.   In other cases there have been found adhesions about the kidney and ureter, or calculous particles in the renal calyces, to which rather than to an idiopathic disturbance of the vaso-motor system of the kidney the renal congestion and tension and the consequent hæmaturia and pain were much more probably due.*

As a correct clinical diagnosis of these cases cannot be made, it is consoling to know that in many of them complete relief follows from lumbar nephrotomy.

Senator and Klemperer have given evidence as to the existence of very abundant hæmaturia in cases of proved **hæmophilia.** Senator relates the case of a young girl affected in this way, upon whom Sonnenburg performed nephrectomy. When it occurs it is usually in young men or boys.   Sometimes pain is associated with the hæmorrhage, but often not.

Hæmaturia, with or without pain, but without other ascertainable or recognisable cause, in a member of a family of

* "Hunterian Lectures," lecture ii., p. 52.

" bleeders," should be treated as due to this constitutional ten-
dency, and not submitted to nephrotomy—but to nephrectomy,
if all other remedies have failed and life is threatened, and not
before. No operation which can possibly be avoided is per-
missible in the case of these persons.

Hæmaturia, in some cases to a rather abundant degree, has
been met with in association with **movable kidney**. I have
explored the movable kidney in several instances, on account of
pain and hæmaturia, and I have found it congested ; and after
the operation the symptoms have entirely ceased. In some of
these cases I have been uncertain as to how much of the
relief ought to be attributed to the fixation and how much to
the nephrotomy ; and whether the symptoms were not caused
by chronic nephritis. In some instances, where the kidney on
exposure and section has had the appearances of chronic
nephritis, I have not fixed it, though I found it very movable,
and yet the symptoms have ceased after the operation, which
looks as if the relief was the result of the nephrotomy. This
cannot be positively inferred, however, because after such an
operation, the kidney is apt to become firmly fixed, even when
no sutures are inserted into its substance or capsule.

When hæmaturia occurs with a movable kidney, lumbar
exploration ought to be performed and nephrorraphy practised,
after full examination of the kidney and downward catheterisation
of the ureter have shown that no other tangible cause for the
hæmorrhage exists.

Guyon has pointed out that hæmaturia occurs in rare cases
during pregnancy. If not caused by direct pressure it is
probably due to congestion of the renal vessels, which are apt
to be influenced by uterine and ovarian conditions.

When there is tumour without hæmaturia.—Having diagnosed
a tumour of the abdomen to be renal, how can we decide whether
the tumour is due to a malignant new growth or to some other
form of renal enlargement ? It is likely to be malignant, if
the tumour occurs in a child under ten, and still more so if
under six or seven years of age ; or in an adult between forty
and seventy ; if it has grown rapidly since it was first discovered,
whether preserving the renal outline or not ; if it has not varied and
does not vary in size and painfulness, with marked variations in
the amount of urine passed ; if there are no crystals, calculous

fragments, or pus or casts in the urine; if by repeated and careful microscopic examination of the urine little masses of new growth are detected; if there is a progressive diminution in the amount of urea; if there is no antecedent history of calculus; if with the growth of the tumour the patient emaciates markedly and becomes sallow; if enlarged glands, intra-abdominal, pelvic, or inguinal, are discoverable; if there is a recent vari-cocele on the same side as the tumour distinctly increasing with the growth of the tumour; if there are signs of venous obstruc-tion in the inferior cava; or if there is any nodule of malignant new growth in any other part of the body.

Too much reliance must not be attached to any one individually of the indications just mentioned, but if several of them co-exist in any case in which the tumour is diag-nosed as renal the probability of malignant new growth is considerable.

When hæmaturia and tumour co-exist. — In renal calculous affections, in tuberculous affections of the kidney, in cystic disease, in hæmato-nephrosis, and in hydro-nephrosis from various causes, hæmaturia and renal tumour co-exist, and will have to be diagnosed from malignant renal tumour.

From **calculous affections** it is diagnosed by the characters of the hæmaturia above described; by the absence of tenderness on pressure, which is so frequent in calculous affections when the kidney is manipulated between the two hands; by the non-occurrence of renal colic after exercise, jolting, or fatigue; by the want of an antecedent history of lithiasis or of former attacks of hæmaturia and pain followed by long periods of quiescence years before the tumour first appeared.*

From **tuberculous affections** by the characters of the hæma-turia; by the absence of pus and tubercle bacilli in the urine; by the absence of tuberculous lesions in other organs; by the absence of an elevated temperature at night; and by the absence of the family history of tubercle.

From **polycystic disease** by the abundance of the hæmaturia, hæmaturia being rare in cystic disease, but when it occurs it resembles the hæmaturia of malignant tumour by its unprovoked onset and its tendency to recur without assignable cause; by the absence of polyuria, or anuria, or uræmia, either or all of

* "Hunterian Lectures," pp. 70–74.

which are met with as early symptoms in polycystic disease, but very rarely indeed occur in cases of new growths of the kidney ; by the absence of that irregular botryoidal outline which is so characteristic of conglomerate cysts ; and by the absence of a tumour on both sides—bilateral enlargement being not at all unfrequent in polycystic disease. In malignant disease the amount of urea may be diminishing but without polyuria or anuria ; in polycystic disease the lessening amount of urea is associated with a great increase in the amount of water, or on the contrary with a suppression of the secretion in great part or entirely.

In cases of **serous cysts** the hæmaturia is either absent or slight, the tumour may fluctuate at some stage of its growth, whilst at others it is very dense and hard, and more resembles a rounded circumscribed solid tumour in the abdominal parietes. I have known a case in which there were sudden fainting fits caused by hæmorrhages into the cyst cavity.* Cancer may be engrafted upon such a renal cyst.†

The difficulties which surround the diagnosis of these very rare cases of greatly enlarged simple cysts are considerable, and it is sometimes impossible to distinguish them not only from cases of nephrectasis, but from solid tumours of the kidney or of some other intra-abdominal organ or tissue.

The diagnosis of **hydatid cysts of the kidney,** which are very rare, from malignant tumour must in most cases remain uncertain, unless daughter cysts or hooklets are discovered in the urine, or the tumour gives the characteristic hydatid fremitus, or fluctuates.

Another source of error in the diagnosis of malignant tumour is due to the fact that **hydro-nephrosis** is in some cases accompanied by hæmaturia, and may therefore be mistaken for a new growth of the kidney. This is especially likely to occur if the cause of the hydro-nephrosis happens to be a tumour—villous papilloma or carcinoma—of the bladder. I have on several occasions been consulted on account of hæmaturia with or without renal enlargement, which has been regarded as due to some affection of the kidney, when the disease has really been a new growth in the bladder around the orifice of the ureter of the suspected side. Such growths may cause continuous or intermittent

* *Path. Soc. Trans.*, vol. xxii., p. 171.
† *Ibid.*, vol. xxi., p. 253 and vol. xxii., p. 171.

hydro-nephrosis, and spontaneous profuse irregularly intermittent hæmaturia having all the characters of renal tumour.

The diagnosis can be made by bimanual examination of the bladder under chloroform after emptying it of its contents ; then with one finger in the rectum and the fingers of the other hand depressing forcibly the abdominal wall in the hypogastrium, the collapsed vesical walls can be thoroughly felt and any difference in thickness or resistance appreciated. The induration and unyielding feeling of an infiltrating malignant growth is readily detected by the experienced fingers ; and a soft villous papilloma large enough to give rise to the symptoms of hydro-nephrosis can be felt within the vesical cavity like a piece of saturated sponge between the fingers (see a paper with recorded cases by the author in the *Lancet*, October 31, 1896). The cystoscope may be employed whenever a new growth of the kidney is suspected ; but with the bimanual method of examination just described all the information requisite for a correct diagnosis can be obtained in these cases without resorting to the intra-vesical inspection.

Unless due to the cause just stated it is not common for the hæmaturia in hydro-nephrosis to be either abundant or bright red as it is in renal tumour.

In some of the cases of renal distension from vesical new growth which have been under my charge high temperature and shivering have been prominent symptoms.

Diagnosis of the variety of new growth.—In the adult it is generally almost impossible to diagnose with any degree of certainty the nature of the tumour. Sarcoma is more frequent than carcinoma in the earlier decades of manhood (twenty to forty), epithelioma in the later (forty to seventy) ; sarcoma causes hæmaturia less frequently, secondary growths more slowly, and has a duration of from five to six years, instead of from three to four years as has carcinoma.

But these distinctions cannot be relied upon. It is impossible clinically to diagnose adenoma from epithelioma, and even with the microscope the distinction is far from easy and not always possible.

It is often quite impossible to make the diagnosis of malignant from benign renal tumours and from pararenal growths except by an exploratory incision, and often a microscopic

examination of the growth does not permit of a decisive
judgment being formed. Very variable opinions are ex-
pressed by equally competent microscopists about the nature of
the same tumour. The facts of the tumour being encapsuled
and that on section the microscopic characters are those of an
adenoma do not prove the non-malignancy of the growth or
give a certain guarantee against recurrence. In the case of a
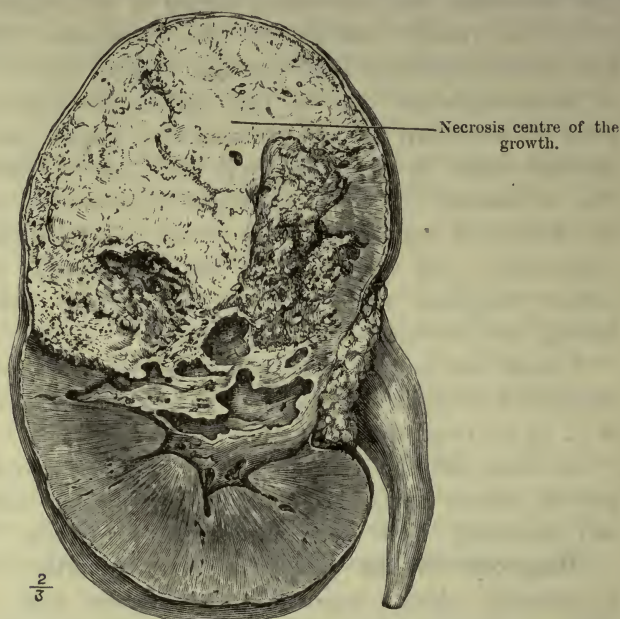lady whom I saw in consultation, a renal tumour removed and

Fig. 91.—Carcinoma of the upper half of the kidney confined within the renal
capsule. There were secondary deposits in the brain, lungs, and bronchial
glands. Pyelitis existed. From a man aged 38. (*See* also Figs. 92 and 93.)

described by Mr. Stanley Boyd as an adenoma, recurred within a
few months, and formed a tumour much larger than the original mass.*

The diagnosis of adhesions and secondary deposits is of import-
ance from the point of view of treatment, but it is not always
possible to exclude these without an exploratory incision. The long
duration of the symptoms, the absence of mobility and *ballotte-
ment* of the tumour, the œdema of the tissues in the loin, vari-
cocele, œdema of the leg on the affected side, and the detection
of enlarged glands within the abdomen along the brim of the

* *Path. Soc. Trans.*, vol. xlix., p. 175.

pelvis or in the groin will indicate extension of the disease and make the prospects of an operation unfavourable. A careful examination of all the other organs of the body for signs of secondary growths should be made.

Prognosis.—When once the disease has set in, sarcoma and carcinoma and other malignant forms of new growths advance steadily. The usual causes of death are exhaustion, hæmorrhage, or uræmia ; the more rare are ulceration, or bursting of the growth into the peritoneum or through the diaphragm into the lung causing pulmonary abscess, or secondary new growths in the brain (Figs. 91, 92, 93), vertebral column and spinal cord, stomach or intestine. The cases in which the course and progress of the disease seem to have been arrested for many years, and then to have advanced again, must be accepted with some reserve. It is not improbable that the earlier symptoms in these and such-like cases were

Fig. 93.—Secondary Tumour in the Right Temporo-Sphen oidal Lobe. From the same patient as Fig. 91.

Fig. 92.—Secondary Tumour of Brain. Exact size of the tumour. From same patient as Fig. 91.

due to some other disease, and that the malignant growth was engrafted upon it. This was almost certainly the case in the cancer which was associated with a large renal cyst, and which I reported years ago to the Pathological Society of London (*see* the *Transactions*, vol. xxii., p. 172).
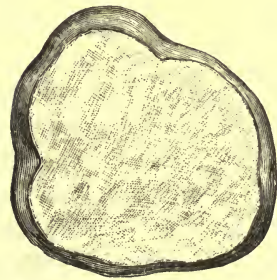
It is not necessary for the renal tumour to have attained a large size before it causes secondary deposits in other organs. Thus, in the case from which the specimens illustrated in Figs. 91, 92, and 93 were taken, the renal new growth was the size of a Tangerine orange, occupying the upper

pole of the kidney and contained within the renal capsule; the lower part of the kidney was natural and no tumour was detectable during life; and cases are on record in which new growths in the neck or in the limbs have been secondary to a growth in the kidney which was only detected during an operation or after death.

The duration of the tumour between the discovery of the first symptom and the date of death, when no operation has been performed, is from three to four years for carcinoma and five to six years for sarcoma.

Guillet has collected five cases which survived from four to ten years, and six cases from ten to sixteen years.

The liability to secondary deposits, although not so decided in the case of the kidney as in many other organs, is still great, and is of course of extreme importance when considering the advisability of an operation. Likewise, it is also of the greatest importance in considering the prognosis and treatment of a renal tumour to make sure that a primary growth in some other organ has not been overlooked. Death may supervene very rapidly if the mediastinal glands become secondarily affected. In a case sent to me by Dr. Casley of Ipswich, in June, 1899, there was a soft friable carcinoma affecting a portion of the left kidney, the rest of the organ being quite healthy. It was fortunately decided that no operation was advisable, as the patient died somewhat suddenly eighteen days later from dyspnoea due to the pressure of carcinomatous deposits in the mediastinal glands and the glands at the roots of the bronchi.

The following statistics will show the frequency with which secondary deposits occur in malignant disease of the kidney.

Roberts in fifty-one cases found secondary growths in thirty-one, while in the remaining twenty the kidney alone was attacked. Dickinson found secondary growths in fourteen out of fifty-nine cases. Rohrer in 115 cases found secondary growths in fifty, and Guillet in forty-seven out of seventy cases. The lungs appear to be the most frequent seat of secondary deposits, but the liver and lumbar glands are also frequently affected while the suprarenals are often implicated by direct continuity. Guillet has attempted to compare the relative infectivity between renal carcinoma and sarcoma : he found secondary growths in thirty-two out of thirty-eight cases of carcinoma and in four out of eight cases of sarcoma in adults, while in sarcoma of children he found secondary deposits

in eleven out of twenty-four cases. From the consideration of numerous statistics, Guillet concludes that secondary deposits occur in about two-thirds of all cases of malignant disease of the kidney, that they are very frequent in carcinoma, and occur in about half the cases of sarcoma.

Treatment.—Death is the inevitable result of every malignant tumour of the kidney if left to itself; and so rapid is its advance in children that the fatal termination usually supervenes very quickly upon the first discovery of the existence of the tumour. If therefore nephrectomy can cure even a large minority the operation would not only be justifiable but would be hailed with satisfaction by surgeons and patients, even though death in some instances is somewhat hastened by it. The chance of cure by operation would be well worth the risk when the alternative is certain death, especially if the chance can be shown to be three or four to one in favour of the operation. This point then ought to be first investigated.

Thanks to the better recognition of the signs of renal tumour a diagnosis is nowadays made at a much earlier period than formerly; at a period, that is, when the growth is yet small or of but medium size. Moreover, the technique of nephrectomy is better understood and better practised, so that the operation has been performed under more favourable conditions than formerly, with the result that not only has the whole of the disease been more frequently removed but the immediate mortality of the operation has been reduced between half and two-thirds.

Dickinson, writing in 1882, stated that so far as he knew the kidney had been removed in eleven instances for malignant tumour, with these results : six deaths, five recoveries, *i.e.* a mortality of 54·6 per cent., whilst as to the permanence of the cure two of the five were known· to have lived and to have been in good health two years and four months and two years and six months respectively after the operation. Of the other three, one died of recurrence about nine months, one of recurrence about six weeks after the operation, and of the other no later history was known beyond the fact that the patient perfectly recovered from the operation. A larger number of cases yielded worse results. Guillet's figures of all the nephrectomies for malignant renal tumours performed up to 1888 showed a mortality of 72 per cent. Chevalier, in 1891, found 58 per cent. mortality, but

his list was weighted by a good many deaths from trans-peritoneal nephrectomy, whereas twenty-one of the more recent lumbar nephrectomies in his collection gave a death-rate of only 25 per cent. Other collections of this date showed much the same results : thus in Siegrist's in 1889 there were nineteen recoveries out of sixty-one operations, a mortality of 68·8 per cent. ; Barth's, in 1892, 42 per cent. When we come to later statistics a marked improvement is seen.

Küster, in 1896, by his collected cases showed a mortality of 24 per cent. ; Max Jordan, in 1895, 20 per cent.

Rovsing, who reviewed the results of operations performed between 1890–95, found a mortality of between 20 and 25 per cent.

The results obtained by each individual operator are variable, but show improvement in later years. Czerny, for instance, in his first nine cases had a mortality of 75 per cent., whereas his following nine cases all recovered. Tuffier's mortality up to 1888 was 65·2 per cent., and it has since fallen to 5 per cent. ; but the number of his cases is not given. My own results in nephrectomy for malignant tumour in the adult have been deaths in the two first cases, namely, in 1885 and 1886, and ten cases since without a death, that is, a mortality of 16·6 per cent. Küster lost three patients out of eight, whilst Israel lost three out of twenty-four, i.e. a percentage of only 12. Albarran has reported upon four cases all of which recovered from the operation.

The most recent statistics of a large number of cases are those given in the Thesis recently published by Heresco.* Out of 165 nephrectomies for renal malignant disease collected from records published between 1890–98, thirty-two of the patients died within a month of the operation, which, roughly speaking, gives a mortality of 19·35 per cent. Of these 165 operations, 112 were performed on adults and twenty-three of the patients died from the operation, which yields a death-rate of 20·5 per cent.

From the above statistics we see that the mortality has been reduced from between 68 and 72 per cent., at which it stood till 1889, to between 20 and 25 per cent., which has been realised during the last eight years. So far as we can tell at present it would seem that this death-rate is not likely to be much further diminished if we take all cases and all operators into

* "Tumeurs Malignes du Rein," Paris. 1899.

account, though the results of individual surgeons, with special experience in renal work, or who are more exclusive in their selection of cases for operation, may be lower. If this be so nephrectomy for malignant tumours of the kidney must be credited with hastening the end of nearly a quarter of the patients submitted to it. But this, as we said above, would be deemed a far from unsatisfactory result in the case of an absolutely fatal malady if it could be shown that the surviving three-quarters were cured or obtained a considerable prolongation of life by undergoing the operation.

In order to arrive at a just appreciation of the general effect of nephrectomy on life, *i.e.* at the precise value of it as a means of prolonging life, we want to know, in addition to the risks of the operation itself, (1) what number of the 75 per cent. who survive the operation are permanently cured, and (2) to what extent, if at all, life is prolonged by the operation in those who die after it of recurrence of the disease.

We know that the mean duration of life of a person affected with cancer or sarcoma of the kidney is from three to four years ; and that it has been in some cases prolonged to six, eight, ten, and even seventeen years. We know, too, that after malignant tumours of the kidney have attained to considerable size life may still last for two or three years. Guyon and Albarran, for instance, testify to the fact that two patients were able to attend to their occupations three years and five years respectively after they were discovered to have very large malignant tumours of the kidney.

These points must be borne in mind in judging of the thera-peutical efficacy of nephrectomy ; and our experience is not sufficiently large, nor I fear sufficiently precise, to enable us to make a just comparison between the duration of life, from the date of the first symptom to death, of the patients who have not been operated upon, and of those who have been oper-ated upon but who died from recurrence of the disease.

It is impossible to obtain in all instances the distant results as to the duration of life after the operation and the dates and frequency of recurrences, so that our information is much less accurate and convincing on these points than as to the im-mediate results of the operation. Enough, however, is known to prove that recurrences are very frequent, especially in the

case of tumours of large size and those which had contracted adhesions. Within six months a great number of recurrences are noted; and if Bloch, Wagner, Max Jordan, Helferich, Czerny, Küster, Israel, and myself can report recurrences at such long intervals after the operation as three years, ten years, two and a half years, three and a half years, two years, twenty-three months, four years, and three and three-quarter years, still these results ought only to make one the more careful in giving a distant prognosis after nephrectomy, even in the most promising instances. Heresco's figures show that eighty-nine out of 112 adults operated upon survived the operation. But later information was only obtained about sixty-two of them. Of these, thirty-six were alive and well at dates varying from two months to seven years, twenty-two died from recurrence of the disease at periods varying from three months to three and a half years, and four died of inter-current diseases without recurrence of malignant disease, at periods varying from six weeks to four and a half years.

Of my own operation cases, one out of eight lived for two years and between nine and ten months (*i.e.* nearly three years) after the operation and then died of recurrence of the disease in the ovary and liver. Of the others, four died of recurrence between six and twelve months after the operation, two within three months, and one is still living and well three months after nephrectomy.

Many cases are recorded, however, in which recurrences have followed at long intervals after the operation. The following cases are examples : A patient of Bloch's lived three years ; one of Wagner's, ten years ; Max Jordan's, two and a half years ; Helferich's, three and a half years ; Czerny's, two years ; Küster's, twenty-three months ; Israel's, four years ; my own, about thirty-four months ; Siegrist's, four years.

Wagner collected twenty-four cases, alive and well, more than two years after the operation ; Billroth had two cases which survived more than two years, and of these twenty-six cases, fifteen survived three years. Israel records patients living six, nine and ten years respectively. Thornton removed a large adrenal tumour weighing eleven pounds from a woman, aged fifty-three, who was alive and well six years after, and Ris excised an adeno-carcinoma from a woman who was living and well five years later.

But, though the mortality of nephrectomy for malignant renal tumours has diminished from one-half to two-thirds, and though in exceptional cases complete cures seem to have occurred, still in the majority of survivors from the operation the duration of life is but short.

Growths of large size give results less favourable in immediate results, and a greater proportion of recurrences. This is because fragments of the tumour or of implicated lymphatic glands have often had to be left behind owing to their intimate adhesions to the large vessels of the abdomen. Still, life has in some few cases been prolonged after the removal of very large tumours, e.g. Terillon's patient lived two years and three months after removal of a tumour nearly ten inches in length. Schode's patient aged thirty-nine lived four years after the removal of a sarcomatous tumour the size of an adult's head. One of Israel's patients was alive and well fourteen months after nephrectomy for sarcoma; in this case a gland which was adherent to the renal vein, and three others which were adherent to the vena cava, were also excised.

In my earlier work on the kidney I remarked as to the treatment of malignant tumours of the kidney : " This can only be palliative in the middle and later periods of the disease. In the very early stage, could the growth be recognised then, nephrectomy would seem to offer a prospect of postponing the fatal result, perhaps even of considerably prolonging life, and in exceptional cases of securing permanent immunity." The accumulated experience of surgeons since 1884, unhappily, does not permit of a more favourable or more precise summary now.

As stated above, we want more precise information as to the comparative duration of life (from the earliest evidence of the presence of a malignant tumour of the kidney till death) of those in whom the disease has been allowed to take its course on the one hand, and of those who have undergone nephrectomy on the other.

It is also to be hoped that before long more exact information will be forthcoming both as to the clinical history and histological characters of the tumours which have been removed, so that we may know better which of the kinds of malignant tumours afford the best prospect of complete cure or of longest immunity from recurrence after nephrectomy ; and whether there are any

diagnostic symptoms characteristic of the different histological
varieties of growths—the sarcomata, carcinomata, and the adrenal
or accessory adrenal tumours.

Heresco has gone some way towards throwing light on the
first of these points, but I feel a little hesitation about his
figures as giving quite the true results, because there seems
to have been a certain amount of selection of the cases in
his list. His figures, however, are instructive, and stand as follows :
Of sixty-eight cases of nephrectomy for all forms of sarcoma,
fourteen died, i.e. a mortality of 20·5 per cent. ; of fifty-three
cases of nephrectomy for carcinoma of various kinds, twelve
died, i.e. a mortality of 22·56 per cent. ; of fourteen nephrec-
tomies for adenoma all were successful, and of seventeen for
struma supra-renalis, five died, i.e. a mortality of 29·4 per cent.
Of the sarcomata, fourteen were known to be well at periods
varying from two to seven years after the operation. Of the
cancers, four were known to be well at periods between two
years and five years and three months ; and of the struma
supra-renalis cases three were alive and well at periods from two
and a half to four and a half years after operation. Thus, the
relative numbers of persons who survived the operation and were
free from recurrence two years or longer after nephrectomy,
for the three separate classes of cases, were 25·9 per cent. for
sarcoma, 25 per cent. for struma supra-renalis, and only 9·7
per cent. for carcinoma — 33 per cent. of the survivals after
nephrectomy for sarcoma had recurrence within one year, 25
per cent. of the adrenals, and only 9·7 per cent. of the cancers.

The principles which must guide us in dealing with any given
case are the same as those which we follow in regard to cancer
of the mammary gland and indeed of malignant disease generally.

Are the neighbouring lymphatic glands too widely invaded to
be completely removed ? Are there secondary growths in any other
organ or tissue ? Has the tumour any important adhesions, or has
it infiltrated irremovable structures ? In short, can the whole of the
disease be removed and is the patient's strength and general state
of health sufficiently good to allow of the operation being well
borne ? If these questions can be satisfactorily answered, nephrec-
tomy ought to be performed at as early a date as possible.

Good results may be hoped for only when the tumour is
small, or of but moderate size, when it is not adherent, and

the neighbouring lymphatic glands are not invaded. Some of the larger tumours are also sufficiently circumscribed to allow of complete extirpation, and for such also nephrectomy is the treatment to be advised. It is not, however, possible to state with precision what the connections of the tumour or the extent of glandular invasion are without an exploratory operation, and not in all cases even then. When there is doubt on these points and yet the patient's age, general state of health and his wishes are in favour of an operation, a direct examination through an exploratory incision should be made, and the operation abandoned if the conditions which justify nephrectomy are not found to exist. In certain circumstances the exploratory operation may be followed by great benefit. I have twice thus operated on patients in whom the tumour was causing intestinal obstruction, and in both cases complete relief from this state was obtained, in one of them by detaching two processes of omentum which passed across and bound down the colon.

It is only in exceptional cases—where, for instance, death is threatened by hæmorrhage or pressure effects, or where the pain caused by the tumour is unendurable—that nephrectomy is justifiable when we know that infiltrated tissues or infected glands must be left behind.

It may happen, after the tumour has been removed, that some non-removable infected gland, or mass of secondary growth, may be found, which was inaccessible whilst the tumour was *in situ*. But in order to avoid submitting the patient to the risks of the operation when the whole of the affected parts cannot be removed, a most careful preliminary examination should be made in every case.

On one occasion I removed the enlarged kidney in the presence of numerous small secondary nodules of the liver, but in that case the tumour was causing very great pain, and was itself very movable and free from adhesions. The result justified the operation, as the patient was quite relieved of his sufferings, and lived for eight months afterwards.

Nephrectomy.—Of the two methods of nephrectomy for malignant growths, the lumbar and the abdominal, the lumbar is now by almost universal consent regarded as the operation of choice for tumours of small and moderate size. The earlier statistics, however, show a much larger difference in the mortality of the two methods than the later.

Siegrist in sixty-one cases found 57 per cent. of deaths by the trans-peritoneal and 23 per cent. by the lumbar.

Chevalier's figures are almost the same, viz. 59 per cent. for the trans-peritoneal and 24 per cent. for the lumbar.

Heresco's statistics of cases published between 1890 and 1898 show forty trans-peritoneal operations with nine deaths, *i.e.* a mortality of 22·50 per cent. ; and fourteen deaths out of sixty-four cases, *i.e.* 21·90 per cent., of extra-peritoneal nephrectomy.

For very large tumours the abdominal method, however, must be adopted ; and it must also be conceded that by the abdominal route a more immediate examination can be made of the hilum and pedicle of the kidney, and of the retro-peritoneal glands along the same and on the opposite side of the spinal column. In the earlier statistics recurrences were less frequent than after the lumbar method. It is, however, by the abdominal method that such fatal accidents as ruptures of the vena cava have occurred.

Strongly in favour as I am of the lumbar method of nephrectomy for other diseases, I have always combined the lumbar with the lateral trans-peritoneal route for malignant tumours of the kidney. I first make an incision into the peritoneal cavity, along the linea semilunaris, and through this I examine the connections of the tumour. I then temporarily close this wound and turn the patient over upon his sound side, and through the usual oblique lumbar incision I enucleate the tumour from behind. The patient's position is then again changed, and the peritoneum is raised from the front of the tumour, the vessels of the pedicle are secured, and the tumour is then pushed and raised out through the anterior wound.

This plan possesses the following advantages : (1) It enables the surgeon to make a wide exploration before beginning the separation of the kidney and the tumour from their connections.

(2) It gives the opportunity of feeling and inspecting the other organs, and the mesentery and peritoneum, and so of detecting any early and unsuspected secondary growths.

(3) It allows of the posterior, the upper, lower, and outer connections of the tumour being detached whilst the tumour itself is being pressed towards the spinal column, instead of the great vessels being dragged and forcibly pulled away from them, as happens when this detachment is made through an anterior

wound.   It thus diminishes the risk of injury to the great vessels.

(4) The delivery of the tumour through the anterior incision is very greatly facilitated by one hand of the surgeon in the posterior wound.

(5) The pedicle can be more precisely manipulated than through either wound alone.

(6) The lumbar wound affords the best means of draining the space from which the tumour has been extracted.

Partial nephrectomy has been practised at least five times for malignant tumours of the kidney; but in every case the surgeon thought he was dealing with a benign tumour. Czerny in 1887 excised part of a kidney for an angeio-sarcoma which followed a subparietal injury to the organ. Recurrence took place, and the kidney was removed two years later, the patient dying five months afterwards.

Kummel resected a part of the kidney for a malignant neoplasm of the upper end of the organ; the patient died two and a half months after the operation. Bloch removed half the kidney for an adeno-sarcoma; the patient was alive two months afterwards. Tuffier did a partial re-section for an adeno-carcinoma; the patient recovered from the operation, but I do not know the ultimate result.

Albarran resected part of the kidney for a sarcoma, and the patient was alive more than two years after, but recurrence was then probable as she had hæmaturia. Mayo Robson excised part of the kidney with a supra-renal tumour.*

The results of partial nephrectomy are not encouraging. Total nephrectomy should be practised for cases of even very small tumours, if their malignant nature is evident. Nothing less than total nephrectomy should be resorted to in the cystic forms of malignant tumours. Grawitz, Klaatsch, and Rudolphi, after incising such tumours, packed them with gauze, but each of the patients quickly died. Leopold, after opening one of these cysts, resected it, and his patient recovered.

MALIGNANT TUMOUR OF THE KIDNEY IN CHILDREN.

Etiology.—Malignant disease of the kidney is not unfrequent in children. Duran, in the "Thèse de Paris," 1876, says that the eye

* *Brit. Med. Journ.*, Oct. 21, 1899.

and the kidney are the two organs most frequently affected ; out of
124 cases of malignant disease in children, he found the eye in
seventy and the kidney in forty-five the seat of the disease.

Guillet, out of 132 cases of malignant disease of the kidney,
found forty-five in children.

Out of 347 cases of cancer (using the term in its widest sense)
of the kidney operated upon between 1890 and 1897, collected by
Albarran, sixty-three of them were in children.

The maximum frequency is between one and five years of age,
but Seibert, Weigert, Semb, and others have published cases in
which the tumours were congenital. It is during the first five
years of life that children are exceptionally prone to renal sarcoma.

In the adult, cancer of the kidney is more frequent in
men than in women, in children there is no difference in fre-
quency in the two sexes. There have not been any cases to show
that calculus is either an exciting cause or a result of renal
tumour in children.

Pathological anatomy.—The renal sarcoma of early life
originates commonly in the connective tissue of the hilum and
gradually spreads into and expands the renal tissue. It rarely
obstructs the ureter or ulcerates into the calyces, and thus does
not cause hydro-nephrosis, and very rarely hæmaturia ; in some
cases, however, the renal cavity shows signs of compression, the
pyramids being flattened and the sides of the infundibulum in
contact, as in a case of cancer in a child four and a half years
of age recorded by Fagge in the Pathological Society's *Transac-
tions* (vol. xxi., p. 261). The yielding nature of the infant tissues
and the absence of renal distension explain the rarity with which
pain becomes a symptom in these little patients.

Adenomata and epitheliomata are rare in children. Sarcoma
is the form of malignant tumour commonly met with. Shattock,
in the *Lancet*, 1894 (vol. ii., p. 1219), has published a case of solitary
adenoma. Albarran gives eight to forty-three as the proportion
of epithelioma to sarcoma in children. The structure and patho-
genesis of malignant tumours in the child is the same as in
the adult (*see* pp. 550 and 570).

When once the lymphatic glands are invaded the tendency
of the disease to spread in them is not confined to the glands
of the same side and along the median line of the body, but
affects also the glands about the hilum of the opposite kidney,

and in this manner the growth becomes bilateral. Fig. 94 shows a round-celled sarcoma arising about the hilum of the right kidney, which is partly stretched over the surface of the tumour. It was removed from a male infant nine months old ; the glands at the upper part of the hilum of the left kidney, as well as those about the aorta at this level, were found to be infected, as shown in Fig. 95.

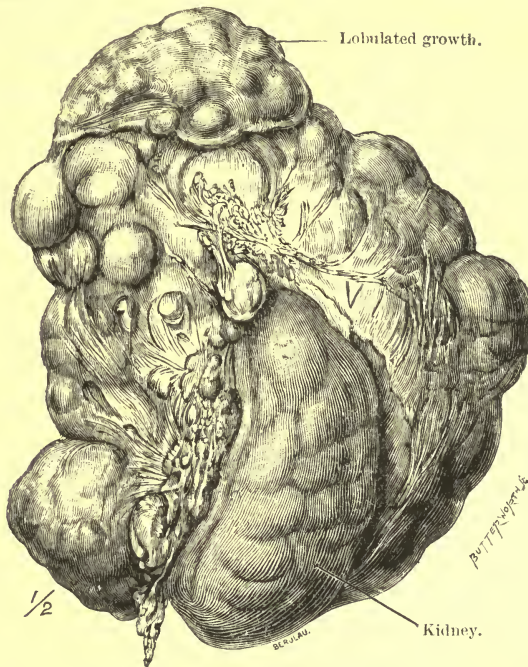Sarcomata have a tendency, no doubt, to attack independently

Lobulated growth.

Kidney.

Fig. 94.—Sarcoma of the right Kidney arising at the Hilum.   *See* also Fig. 95.
From a male, aged 9 months.   (Middlesex Hospital Museum.)

both kidneys, either simultaneously or consecutively, just as they have to affect both eyes or both ovaries ; but the affection of the opposite organ by continuous extension either along the retro-peritoneal tissue or the lymphatic glands is probably more common. In a case of a child, fourteen months old, under Abbe, one kidney was successfully removed for sarcoma, and four years and a half later the remaining kidney became similarly diseased.   In this case the sarcomata of the two organs most probably been quite independent, and both, so to speak, primary growths.

Symptoms.—In the great majority of cases the first symptom is *tumour*. Heresco states that this was so in 81 per cent., whilst pain was the first symptom in 14 per cent., and hæmaturia in only five. This contrasts strongly with the relative frequency of these same symptoms at the outset of malignant disease of the kidney in the adult. As the result of the infrequency of pain and hæmaturia the tumour does not attract early notice. It is not until the child emaciates or the tumour attains a large size, causing the abdomen to be protuberant, that the nurse's or parent's attention is drawn to the abdomen.
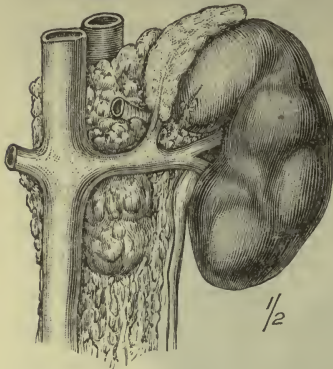

Fig. 95.—The left Kidney showing disease about its vessels and in the glands along the aorta. From a case of Sarcoma of the right Kidney, being from the from same subject as Fig. 94. (Middlesex Hospital Museum.)

Not only is the tumour the earliest symptom, but except for wasting, pallor, and general debility it is the only one. The size attained by it is in some cases enormous. Its local characters are the same in the child as in the adult.

Pain is rare at the outset and occurred in only six out of forty-three cases collected by Heresco. When it is present it is vaguely referred to the loin or over the side of the abdomen on which the tumour is situated, or it may radiate to the thigh and along the course of the genito-crural nerve. The passage of clots of blood may cause renal colic, but very rarely does so.

Hæmaturia. — The most divergent statements have been made by different authors as to the frequency of and importance to be attached to hæmaturia as a symptom of malignant renal disease. Only those based upon actual figures will be referred to here.

It may occur as an early or late symptom. There may be one attack or several. It may entirely disappear before the end of the disease, even when there have been several attacks. The quantity of blood passed may be much or little; sometimes it is only microscopic in amount, but generally when present at all it is sufficient to colour the urine.

It is like the hæmaturia from malignant renal growths in adults: spontaneous, sudden, intermittent, occurring without

premonitory or accompanying symptoms. The attacks of hæma-
turia usually last four or five days; in one case it continued
for fourteen consecutive days (Lotheissen).

Hæmaturia has seemed to relieve or remove pain when pain
has preceded the hæmorrhage. When hæmaturia is an early
symptom it is probably due to congestion of the kidney caused
by the presence of the tumour; when a late one, by ulceration
or bursting of the growth into the renal tubules or calyces.

Heresco found it as an early symptom in only two out of
forty-three cases. Guillet noted it as occurring at some period
during the course of the disease in only ten out of thirty-eight
cases of sarcoma. Albarran found it mentioned in nine only
out of fifty-six cases operated upon for malignant tumour.

Denaclara, out of 409 cases of all kinds of new growths in chil-
dren and adults, found hæmaturia recorded in 146 of them; 132 of
these cases were in children below ten years of age, of whom
thirty-seven had hæmaturia, i.e. nearly 39 per cent. It was
much more frequent in children under five years of age than
over; twenty-seven out of the thirty-seven patients were under
five, and in one the age was not stated. In five cases of malignant
tumour and in three of non-malignant, the hæmaturia appeared
before the tumour; in three instances hæmaturia followed the
tumour. The periods in relation to the tumour at which hæma-
turia was first observed, varied from two months before to three
months after the discovery of the tumour. In two other cases
hæmaturia was an early symptom, though not preceding the
tumour. In three cases there was only one attack of hæmaturia,
and in one case the hæmorrhage lasted as long as the disease.

The rapid growth and frequent bilateral development lead to
early pressure symptoms. Varicocele has not been noted amongst
the pressure effects. Metastasis is not a marked feature. Cachexia
is developed early, and is much more rapid in the child than
in the adult. Death, which is postponed in the adult till be-
tween the third or fourth, or even fifth or sixth year, occurs usually
in the child within one year.

Diagnosis.—This is the same as in the adult (*see* p. 585).
The tumour is. the leading symptom, and in any case of an
abdominal tumour in a child we ought to think of sarcoma of
the kidney and investigate the swelling and the urine from that
point of view.

Renal tuberculosis and vesical tumours, the other diseases of the child in which hæmaturia occurs, are very rare. The characters of the urine in tuberculosis, and the detection of a tumour within the bladder by bimanual examination, i.e. rectal and hypogastric palpation combined, will enable the diagnosis to be made. Hæmaturia, peristent and abundant, due to Bright's disease, has been met with in a boy (Albarran), but is exceptionally rare.

Treatment.—Jessop, in 1877, first successfully removed a malignant tumour of the kidney from a child. The patient died afterwards from recurrence of the disease. Heuter, in 1876, had previously removed a sarcoma of the kidney from a little girl, aged four, but the patient died of hæmorrhage.

Before 1890 the mortality from extirpation of the kidney in the child for malignant disease, as given by Heresco, was 60 per cent.; this is based on the collected cases of Taylor, Guillet, Dohrn, and Chevalier. Fischer quotes thirty cases of nephrectomy with a mortality of 48 per cent., and the longest survival after operation was one year and a half. In 1894, Döderlein found a mortality of 40 per cent. in forty-nine collected cases of operation for malignant tumour in children.* Ardle in the same year gave a mortality of 20 per cent. in twenty-six cases. Albarran brings the figures down two years later with ninety-seven cases to the end of 1896, and a mortality of 30 per cent. Lewy in sixty-two cases found an operative mortality of 28 per cent. Heresco has collected 165 nephrectomies for malignant disease performed between 1890 and 1898, with a mortality of thirty-two, or 19·35 per cent. He has considered as deaths from the operation all those dying within one month from the date of its performance. Of these operations fifty-three were performed upon children, with nine deaths, i.e. a mortality of 17 per cent. The method of operating in these fifty-three cases is stated in forty, viz. the trans-peritoneal in thirty-four cases, with seven deaths, i.e. a mortality of 20·6 per cent., and the extra-peritoneal in six cases, without a death.

Heresco further gives the distant results in twenty-four out of the fifty-three children operated upon. They are as follows : eight had no recurrence, and sixteen died from recurrence. Of the eight who were living, three were alive after five years (two of them after six years) ; three were alive between two years

* *Centralblatt für Krank. d. Harn. u. Sexual Org.*, 1894, H. 1 and 2.

and three months and three years and six months; one, fourteen months and another nine months after operation. Of the sixteen children dead of recurrence, one died at the end of three years and six months, three between twelve and twenty-two months, and the rest between two months and ten months (Heresco, p. 25).

The important fact deducible from these elaborate statistics is this, that with improvements in operating and increased experience in renal surgery the mortality has in recent years been reduced more than two-thirds, viz. from 60 per cent. in 1890 to 40 per cent. in 1894, and thence to 17 per cent. in 1898. Chevalier concluded that nephrectomy would have to be rejected in children. Gross and Fischer inclined to this same opinion. But this position requires reconsideration, and the greater improvement in results of nephrectomy warrants Heresco, Albarran, and others in thinking that the advantages of nephrectomy in children will only be known later, and that for the present all we can say is that the improved results of nephrectomy suffice to guide us in counselling the operation in any case in which after careful investigation we are unable to discover signs of dissemination, and when the general condition of the little patient encourages us to hope that the shock of the operation will be well borne.

With the refusal to operate upon cases in which the tumour has attained to a great size, and has infiltrated surrounding tissues, and with the restriction of operations to the earlier stages of renal growths, better results still will be obtained; and whilst operations upon small and medium sized and freely movable growths will become the rule, surgeons will decline to operate at a late stage and upon tumours of large size which have infiltrated the perinephric tissues and lymphatic glands.

The result of this change in practice has not only been to diminish the actual operative mortality, but also to improve the distant results, and to increase the number of patients who survive not only one but several years after the operation without recurrence. This end can only be attained and advanced by prompt diagnosis and early operation.

D. R. Abbe recorded in the *Annals of Surgery* (November 22, 1895, p. 269) two cases of sarcoma of kidney cured by nephrectomy.

Case 1.—A girl, when two years old, was operated upon on April 12, 1892. She was still quite well at the age of five years. The weight of the tumour was two and a quarter pounds.

Case 2.—A child was operated upon November 20, 1892, when fourteen months old. She was alive in April, 1895, and quite well. The weight of the tumour was seven and a half pounds, or just one-half the weight of the child immediately after operation.

The fatty capsule was not removed in Abbe's cases; there was no blood in the urine in either case, and albumen only in one of them. In one case, part of the kidney, being healthy, was not removed. Both were round-celled sarcomata, one containing a good deal of unstriped muscle. In a third case there was recurrence after five months.

Coley mentioned a case of large sarcoma of the kidney in a girl aged five years, removed in September, 1894; seven months later there was no sign of relapse. Other successful cases might be quoted.

The results on patients who survive nephrectomy have been shown above to a certain extent. Of the sixty-six cases collected by Albarran who survived the operation, recurrences are known to have taken place in forty-three, no late information was obtained about eleven, and eleven cases had been seen free from recurrence and in good health at periods varying from one year to two and a half years after the operation.

But recurrences have in some cases taken place late. Thus Trendelenburg records a case of a child, two and a half years of age, operated upon for myo-sarcoma, who died of recurrence one year and a half after the operation. In another case of a child of nine years of age operated upon by the same surgeon for an adeno-carcinoma, the patient died of recurrence five and a half years after the nephrectomy.

The operation may be followed by success no matter at what age it is performed; from six months old upwards the child may recover from it. Of eighteen children of two years old and under operated upon since 1890 only two died from the operation, but only five were known to be living and well at periods varying from seven months to two and a half years afterwards (Albarran). Nor does the size or nature of the tumour prevent success following nephrectomy. Amongst the recoveries there are several cases in which the tumours were very large and some of these have not been followed by recurrence.

As regards the bearing of the nature of the tumour on the remote results of nephrectomy, Albarran's figures give some clue. Five out of the eleven cases of non-recurrence were epitheliomata,

and the case which died at the longest date after operation, viz. five and a half years after, was one of adeno-carcinoma. The prognosis would seem indeed from these results to be more favourable in epithelioma than in sarcoma, because whereas epitheliomata form barely a quarter of the total number of all the malignant renal tumours in children, they give nearly half of the best results.

Considering the very rapid growth and early certain death if the tumour is left to take its course, the conclusions to be drawn from the latest information at hand are in my opinion the following :—

1. Nephrectomy should be recommended in every case in which the surrounding tissues and the neighbouring lymphatic glands are not invaded and in which there are no secondary deposits discoverable, if the general constitutional state of the child gives fair hope of its withstanding the shock of the operation.

2. The operation should be performed at as early a period as possible, before the tumour has attained a great volume.

3. In the commencement, the operation should be undertaken in the way of an abdominal exploration, and only proceeded with if it is found that the lymph glands are not involved and that the whole of the growth can be removed.

4. The operation should be by the trans-peritoneal method, for the following reasons : the ilio-costal space is too small to permit of the necessary manipulations ; and although the operative results are somewhat inferior to those of the lumbar method, the abdominal route allows of a complete examination of the state of the surrounding tissues, of the renal pedicle, and of the vessels and glands along the spinal column and on the opposite side of the column.

The statistical results given by Heresco of the two operations on children are thirty-four cases with seven deaths, i.e. 20·60 per cent., for the trans-peritoneal, and six cases without a death by the extra-peritoneal method. Albarran's figures are, 21 per cent. for the abdominal and 29 per cent. for the lumbar. As they are only the smaller tumours that would be attempted by the lumbar method, Heresco's six cases without a death make this operation compare too favourably with the trans-peritoneal. In actual operative results there is probably little or no difference ; but the chief advantage of the abdominal operation lies in the fact stated above, that it gives incomparably greater facility of exploring the abdominal cavity before deciding on the removal of the tumour.

CHAPTER XX.

TUMOURS OF THE RENAL PARENCHYMA.

(*Continued.*)

(B) Non-malignant Tumours of the Kidney.

Benign new growths in the kidney are very rare, and scarcely form 6 per cent. of renal tumours. Of fifty-one collected cases Aldibert found forty-eight were malignant and only three benign. They are of perhaps pathological rather than clinical interest, inasmuch as they are usually discovered in post-mortem examinations, and do not often give rise to hæmaturia, tumour, pain, or other symptoms. When they attain to a size large enough to form a tumour they may cause discomfort from pressure by their weight and volume, and they are then likely to be mistaken for ovarian or hydatid tumours. The treatment is either partial or total nephrectomy, according to the extent to which the kidney is involved. When the tumour is certainly benign (a point upon which the naked eye is far from being a sure guide) it should be removed, and a large portion of the healthy kidney left behind; this ought to be done in preference to total nephrectomy. The prognosis after recovery from the operation is good in the case of simple fibroma and simple lipoma, but not so when sarcomatous or myxomatous elements are combined with the fibrous or the fatty tissue.

ADENOMA.

Simple adenomata occur in two forms, the papillary and the alveolar (Weichselbaum and Greenish). They may be single or multiple, solid and glandular, or cystic.

The papillary variety originates in the tubules of pyramids, and consists of tubules and acini lined with more or less cubical epithelium, together with papillary formations.

The alveolar adenoma is said "to arise in the convoluted tubes, and closely resembles the true secretory epithelium" (Kelynack).

The simple adenoma presents itself as a small yellowish nodule

of the size of a pea, or larger, in the cortex of the kidney. It is round, circumscribed and encapsuled. It may be either single or multiple, it usually · occurs in persons of adult age, and may be found in both kidneys of the same subject. Several writers speak of adenomata as occurring frequently in kidneys which have been the seat of interstitial inflammation, but others regard the little yellowish bodies found in such organs as being more of the nature of gland proliferation than true new growths. Simple adenomata present great variations in the proportion between their cells and stroma, and in their degree of vascularity. In some the fibrous and connective tissue is very abundant. They may undergo fatty degeneration or actual necrosis.

The pathogenesis of simple adenoma is obscure and uncertain. Some are probably of accessory adrenal origin. Ricker speaks of having seen them in the central parts of infarction cicatrices, having originated apparently from tubules isolated by the cicatricial tissue. Some arise probably, as Albarran suggests, from " rests " of the renal tubules or, as Pilliet indicates, from functionally isolated elements due to an error in development, others possibly from remnants of the Wolffian body. Allen and Cherry state that all their cases seem to have originated in renal tubes and not in adrenal or Wolffian inclusions, and that in not a single instance was there the least resemblance to adrenal tissue.

As stated under epithelial tumours, the types of renal adenomata vary exceedingly, and no definite line can be drawn between them. Some, especially those which are very vascular and those with papillary ingrowths, have a marked tendency to become malignant and enlarge indefinitely. Delafield, Ricker, Klebs, Ziegler, Thoma, and many others all emphasise the fact that adenomata may develope into tumours of a malignant type. They may pass from adenoma into carcinoma, and be followed by the formation of metastatic tumours.

Papillary ingrowths are specially apt to develope in the cystic forms of adenomata (Fig. 97) ; so also are the hæmorrhagic or angeiomatous conditions ; and in some of the latter, in spite of the absence of true blood-vessels, the blood itself is of so normal a character as to suggest that it had been freely circulating up to the last. In other cases the peripheral part of the tumour has presented large blood spaces occupied by coloured blood-clot, and if such

a tumour encroaches upon the renal pelvis, hæmaturia and hæmato-nephrosis may occur.

An interesting example of papillary adenoma has been recorded by Parkes Weber,* in a man aged seventy-two, who was suddenly attacked with hæmaturia and died a day or two afterwards. In each kidney there were two or three little whitish tumours of a more or less globular form; the largest was six or seven mm. in diameter. Sections showed the tumour to consist of tubes lined by small epithelial cells of more or less cubical form. The tubes were
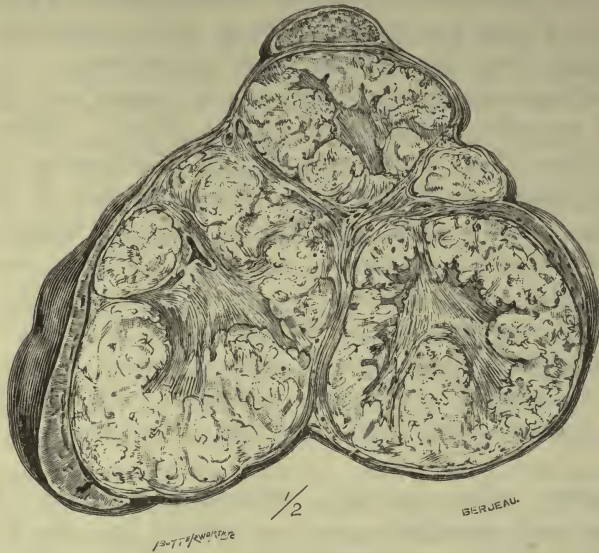
Fig. 96.—Adenoma of Kidney. From a girl aged three years. The tumour chiefly consists of three spheroidal portions separated and intersected by films and connective tissue. The remains of the renal tissue are seen stretched over the tumour. (St. Thomas's Hospital Museum, No. 2095.)

lined with delicate branching papillary outgrowths covered with the same kind of cubical epithelium. Most of the tumour was surrounded by a fairly thick fibrous capsule formed apparently from the surrounding renal tissue which had been compressed by the growth. Parkes Weber has since recorded another case of multiple papillary adenomata in a contracted kidney from a man aged fifty-seven, the other kidney being free from the growths. His view is that such tumours may be regarded as analogous to multiple warty growths developing upon a chronically irritated

* *Trans. Path. Soc. Lond.*, 1898.

skin, and that in certain kidneys as in certain skins and mucous membranes and not in others, chronic inflammation tends to the formation of multiple warty growths.*

R. P. Weir of New York removed the kidney of a man aged thirty-five by the trans-peritoneal route for adenoma in 1887.† The patient recovered. The kidney weighed twenty-one ounces and measured nine by five and a half inches. The tumour was encapsuled, of the size of a man's fist, and it encroached upon but did not burst into the renal pelvis. Microscopical examination

A second small cyst with three or four
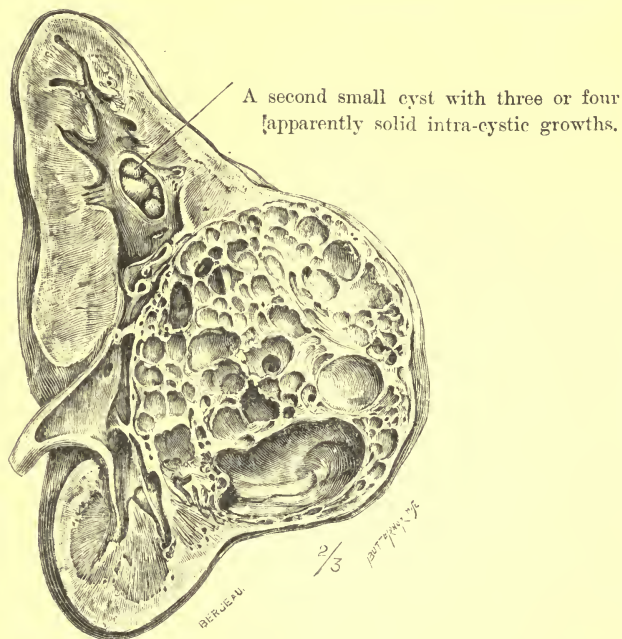[apparently solid intra-cystic growths.

Fig. 97.—Cystic Adenoma of Left Kidney. Removed from a girl aged eighteen, in whom it had existed as a movable tumour for two years. A thin layer of renal tissue is spread between the tumour and the capsule of the kidney. Renal tissue normal. (St. Thomas's Hospital Museum, No. 2096.)

showed it to be an adenoma. Albert ‡ also successfully removed the kidney from a woman aged forty-two years for an adenoma the size of a child's head, by the posterior incision. The tumour followed a fall two years previously ; the fall caused hæmaturia.

* *Path. Soc. Trans.*, 1899, vol. l., p. 179.
† See *Annals of Surgery*, 1887, July–Dec., p. 37.
‡ *Wiener Med. Presse*, 1885, No. 9.

Czerny[*] performed nephrectomy in a child eleven months old for a large adenoma of the right kidney; death from peritonitis followed. Schönborn also has successfully removed the kidney for adenoma from a child aged two years.

The indefinite gradation between the various types is nowhere more concisely or more clearly stated than by Allen and Cherry in the following passages from their excellent pamphlet[†] on "The Histology of Twenty-nine Cases of Primary Neoplasms in the Kidney contained in the Pathological Museum of the University of Melbourne" :—

"The simplest adenoma consists of tubes or alveoli lined or filled with large epithelial cells, which may become hyaline, colloid, or fatty. The softer forms are often composed of cysts with papillary ingrowths, the core of the ingrowths being sometimes fibrillar, sometimes embryonic and cellular, while the epithelial lining varies from a single layer of columnar cells to heaped-up layers of large flattened endothelioid plates. In some cases, many of the ingrowths are pedunculated, and grow freely in the cystic spaces, so as to produce pseudo-glomeruli. All stages may be traced of transformation from simple tubes into papilliferous cysts. Some adenomata are encapsuled, while others abut directly on renal tissue. The adjacent tubes are partly atrophied, fibroid, or otherwise degenerate, but partly show signs of epithelial activity, the nuclei staining deeply. In encapsuled adenomata, similarly active tubes, or cylinders of epithelium derived from tubes, may be found in the capsules. These capsular developments are worthy of close study, for sometimes the epithelial growth is so extensive and so irregular as to produce an alveolar structure resembling carcinoma or alveolar sarcoma, while the main tumour in its macroscopic characters continues perfectly innocent. In other cases, round and spindle cells may be so abundant in the capsule as to resemble sarcoma, but without any corresponding malignity.

"The pseudo-carcinomatous development, just described in the capsule of certain adenomata, may be the main histological type throughout a tumour. In this case the tubules or cysts are replaced by alveolar formations, the alveoli being bounded by

---

[*] *Deutsche Med. Woch.*, 1882, No. 32.

[†] Reprinted from the *Proceedings* of the Intercolonial Medical Congress of Australasia, Fourth Session.

finely fibrillar tissue with spindle cells, and being more or less completely filled with large irregular epithelioid cells, sometimes extensively colloid. These pseudo-carcinomata may remain small, inactive, and distinctly encapsuled. Such alveolar formations may occur side by side with the most typical papillary cysts. Not one of our cases of renal adenoma has passed into typical carcinoma, with corresponding malignant history.

"Adenomata of either the tubular or the papillary cystic type may grow freely and become hæmorrhagic. In some of these cases there is an admixture of ordinary sarcoma tissue, but progressive growth is not necessarily dependent on such admixture."

The adenomata are met with either consecutively to nephritis, or independently of chronic inflammatory conditions of the kidney, as isolated growths, single or multiple, between the capsule and the renal substance, or penetrating more or less deeply into the parenchyma.

The epithelial new growths (papillary adenomata) consecutive to Bright's disease have only an anatomico-pathological interest. They are met with in kidneys the subject of advanced interstitial nephritis, and are found in the parenchyma immediately beneath the capsule as small grey or red nodules from the size of a pin's head a marble. Sometimes there are only one or two of these minute tumours ; in other cases there are very many in different stages of development, and it is by no means unusual for both kidneys to be affected in the same way. They penetrate to a variable extent the renal parenchyma, are generally encapsuled, and have a homogeneous structure, in some cases being tough in texture, in others friable and even hæmorrhagic. They easily undergo degenerative changes, and in doing so probably sometimes give rise to small cysts filled with pultaceous material in the renal cortex.

The isolated adenomata occur in kidneys healthy in appearance or but slightly sclerosed. There may be one or more, rarely two or three, separate tumours. They vary in size from a cherry to a mandarin orange or larger, though occasionally they are as small as a hemp-seed. They are usually situated just beneath the renal capsule, which they somewhat elevate, though they are also partly imbedded in the renal substance and are occasionally entirely surrounded by it. They have distinct, often thick capsules, and on section white bands pass inwards from this capsule, dividing the tumour up into distinct rounded lobules independent

of one another (Fig. 96). The tissue of these little tumours is greasy white, soft and friable, with frequent hæmorrhagic extravasations or cystic formations more or less marked in their substance.

From the point of view of structure Albarran distinguishes three varieties of adenomatous tumours, the canalicular, the tubular, and the alveolar.

The *canalicular type* is the rarest; it is a mimicry of the renal tubules completely developed or on their way towards complete development, and large epithelial nests separated by a delicate stroma.

The *tubular (cavitaire) type* of Albarran includes the papillary adenoma of Weichselbaum and Greenish, and the cubical-celled adenoma of Sabourin, and other forms not described by those observers. These tumours are composed of cavities more or less regularly arranged in the form of tubes, and lined by cubical epithelium with or without intra-cystic papillary growths. They are generally multiple, very small, and correspond to the adenomata met with in Bright's disease. Exceptionally they are solitary.

The *alveolar type* corresponds to the "strumæ lipomatodes aberratæ renis" of Grawitz. They are nearly always solitary tumours, and much larger than the preceding varieties. They are encapsuled, and from the inner surface of the capsule proceed thick bands of connective tissue containing some unstriped muscular fibres, while from these bands other very slender partitions proceed which subdivide the larger alveoli into a great number of small, very regular secondary alveolar spaces. Numerous capillary vessels occupy the stroma. These tumours contain much fat, which led to their being called renal lipomata, but when the fat is dissolved out of them their identity in structure with the suprarenal capsule becomes evident enough. The epithelium contained within the alveoli approaches the cylindrical form, and is infiltrated with fat; the cells, when deprived of this fat, appear like vesicles limited by a fine membrane. Other cells are granular and not fatty. Glycogen is often found in the cells. Tumours of this type sometimes commence in the suprarenal capsule itself, and either involve the kidney secondarily by sheer extension of growth or destroy it by pressure and absorption, as shown in Figs. 76 and 77 (pp. 535. 540).

FIBROMA.

Fibromata occur usually as small white nodules near the bases of the pyramids, but occasionally a very large simple fibrous tumour has been met with in the kidney. Tumours of large size have been found to be composed of fibrous tissue, in some instances mixed with muscular tissue, in others containing cysts. In some cases the tumours have appeared to be developed at the expense of the capsule rather than of the kidney itself, in others to be of truly renal origin.

Wilks, in 1869, described a case in which the right kidney of a man, aged fifty-three, was converted into a very hard, translucent fibro-cartilage-like mass the size of a child's head. It consisted of nothing but fibrous tissue. The renal pelvis was enormously distended. The new growth had invaded and destroyed the renal tissue, and by gradual distension of the renal capsule had preserved the general form of the kidney. In this case a tumour on the right side of the abdomen had been noticed for six years before death, and hæmaturia and lumbar pain four years before the tumour, so that the growth had probably commenced ten years before death.

Dickinson records a case in which a large tumour, weighing six pounds seven and a half ounces, and consisting of inter-branching masses of white fibrous tissue holding a quantity of fatty matter unenclosed in cells, replaced the greater part of the right kidney, and formed a perceptible enlargement in the right hypochondrium.

Bristowe reported a case, very similar to Dickinson's, of a globular, soft, buff-coloured tumour, yielding a cream-like juice, affecting only part of the kidney, and covered with large tortuous veins. On section it was divided by fibrous septa into segments varying in size from a walnut to a bean.

Both of these tumours were probably degenerated sarcomata. Indeed, Dickinson states that, by means of methods of section not in use when these growths were presented to the Pathological Society of London, he subsequently arrived at the conclusion that his own specimen had the characteristic structure of a small-celled sarcoma in which extensive fatty degeneration had occurred.

Billroth removed a large fibro-myomatous growth, which weighed nearly forty pounds, from a woman thirty-five years of

age, but the patient died of peritonitis. Thomas successfully removed a very large fibro-cystic growth from a woman aged twenty-one. It had apparently originated from the capsule of the kidney, and had attained the size of a gravid uterus at eight months.

Bruntzel successfully removed a fibrous tumour, weighing thirty-seven and a half pounds; and nephrectomy for similar fibrous tumours of the kidney has been performed by Peaslee, Wahl, and Bardenheuer.

These tumours may undergo degenerative changes; and simple softening may cause extensive cystic transformation.

The small fibrous tumours the size of a pea or less are not so very rare, and are said to be formed in connection with diffuse interstitial nephritis (Ebstein and Virchow); but Sabourin has shown that many of them at least are not fibrous tumours at all, but adenomata, and consist of glandular tissue resembling the true renal parenchyma. Small encapsuled fibromata are often present in the midst of healthy renal tissue, cortical or medullary. Fragments of tubules have been traced into them.

OSTEOMA AND CHONDROMA.

Roberts stated that a fibrous tumour growing in the substance of the kidney may ossify and transform a large part of the organ into a bony mass. The fibrous capsule of the kidney has also been known to undergo ossification, as in the historical specimen which Elliston sent to Rayer of two ossified renal capsules taken from a man who died with symptoms of apoplexy.

Newman points out that many of the so-called bony growths are in reality calcified inflammatory products. Dickinson says: "There are many preparations in museums which show formations within the kidney of bony hardness; these appear to be usually derived from the transformation of hydatids"; and he refers to specimens in the museums of Guy's and the Royal College of Surgeons in support of his statement.

Roberts, referring to changes which take place in pyelitis and pyo-nephrosis, says: "Sometimes the fibrous septa which separate the compartments are extensively calcified. In an example of this kind which was handed to me for examination, a saw was required to cut the kidney across, and a piece of one of the bony septa which was ground down displayed under the micro-

scope the characters of true bone, though in a rudimentary state. A fine specimen of similar transformation is preserved in the museum of the Owens College." *

Cartilaginous growths are still less frequent than bony, and it is really doubtful if such ever occur. Gluge, however, speaks of a growth apparently consisting mainly of cartilage in a hydronephrotic kidney, and there is in the *Arch. f. Path. Anat.*, 1886, a note of a chondro-sarcoma having been recorded by Hoisholt of San Francisco.

LIPOMA.

True lipomata of the kidney are very rare. They must be distinguished from circumrenal lipomata, which take origin in the substance of or outside the capsule ; as well as from fibro-fatty deposits in and about the kidney, seen after long-standing retention of urine, pyelitis, and inflammation due to calculus. Cases recorded by Weir, Godard, Hullett Brown, and others are examples of fatty transformation associated with calculus, but these and the similar cases associated with septic pyelo-nephritis are degenerative changes, and not new growths. Some of the so-called lipomata described by Robin and Virchow and afterwards studied by Lecampe-Lousteau and by Hartmann have been shown by Grawitz, Lubarsch, Manasse, Müller, and others to be small sub-capsular inclusions of aberrant adrenal tissue, or of fatty tissue mixed with muscular fibres. Grawitz, however, admitted the occasional occurrence in the kidney of genuine lipomata. Small renal lipomata are apt to be mistaken for metastatic abscesses in persons dying from some suppurative disease, or for secondary new growths in persons dying from some malignant primary disease such as glioma of the brain. Two such cases have been recorded by Dr. Lazarus-Barlow,[†] one being a man aged seventy years and the other a woman aged thirty years. The lipomata were about the size of a Spanish nut, pale yellow in colour, composed of fatty tissue of the ordinary kind, and were not surrounded by a capsule.

Various minute tumours—fibromata, lipomata—of the renal cortex may easily be set down, as Parkes Weber has pointed out, as adenomata if no microscopic examination be made.

The true lipomata are small, sometimes the size of a millet

* " Urinary and Renal Diseases," p. 509 (1885).
† *Brit. Med. Journ.*, Sept. 29, 1900, p. 24.

seed, seldom larger than a cherry; single or multiple; situated in
the cortex, and frequently immediately under the capsule, and not
in the region of the hilum where fat is normally present.   They
are rounded in form, sometimes lobulated, and of a grey colour.   To
the naked eye they look like papillary adenomata.   When mul-
tiple and numerous, though each individual tumour is small,
they may increase the volume of the kidney to that of a child's
head.   Renal lipomata are sometimes associated with granular
disease of the kidney, and this fact has been used as an argu-
ment in support of the view that they originate in a fatty
modification of masses of connective or ordinary fibrous tissue.
Only a few of the lipomata are composed entirely and purely
of fatty tissue.   In most, numerous fibrous or muscular fibres
are found on microscopic section.   " Heteroplastic " lipomata (as
Virchow called them, there being no true fatty tissue normally
present in the renal parenchyma) result from the fatty trans-
formation of connective tissue or fibro-blastic cells.

Manasse, Lubarsch, and Müller describe myo-lipomata and
lipo-myo-sarcomata.   Manasse reported two cases of lipo-myoma
in women of eighty-six and forty-four years of age respectively.

A large amount of fat may be mixed up in a sarcoma,
and true malignant growths may undergo fatty degeneration.
Fagge uses the term carcinoma lipomatosum to describe a variety
of cancer.

Ebstein records a case of lipoma occurring in the left kidney
of an elderly woman, which doubled the natural size of the organ.
The patient died of marasmus.

Warthin, quoted by Kelynack, has recorded a remarkable
case of fibro-lipoma of the left kidney of a woman, aged thirty-one,
which caused an irregular tumour the size of a child's head.
This growth extended into the pelvis, was fixed and very sensitive
on examination.   The uterus was anteverted, its cervix patulous,
and the vaginal wall on the left side was very tense.   The
tumour was 14 inches long, 8 inches wide, and 6 inches thick,
and weighed two pounds.   It was removed by operation, and
the patient entirely recovered.   It had the appearance of a
dilated cystic kidney and ureter, filled with a solid elastic mass.
It had grown from the interstitial tissue of the kidney substance
and not from the kidney capsule, and in such a manner that
the atrophied renal substance, exhibiting the changes of chronic

nephritis with amyloid degeneration, was spread like a capsule over the tumour. The external surface of this capsule resembled that of the kidney capsule, presented no fatty tissue, but was covered with stringy portions of the perinephritic connective tissue from which it had been separated. The tissue of the tumour passed directly into the connective tissue surrounding the larger blood-vessels between the cortex and the medulla, as well as into that beneath the pelvic epithelium, pushing the pelvic epithelium before it, and so acquiring a surface layer of transitional epithelium of the same kind as that of the pelvis.

The ureter was dilated and thickened, and into it projected a remarkable prolongation of the tumour, six inches long, terminating in a smooth blunt end. This prolongation had no attachment whatever to the ureteral walls, though it filled the lumen. The tumour—which resembled exactly a large lobulated lipoma—as well as the prolongation of it into the ureter, was composed of fibro-adipose tissue. The two elements—fibrous tissue and simple lipomatous tissue—were not equally distributed throughout the tumour ; the sections of some parts were like those of a hard fibroma, with but few fat cells ; in other sections, the fat cells greatly predominated over the fibrous tissue, and the typical appearances of adipose tissue perfectly resembling an ordinary simple lipoma were presented. There was nowhere any resemblance to sarcoma. The mucous membrane of the ureter was thickened and uneven, presenting to the eye small cyst-like papillæ yellowish or brownish in colour. These little cyst-like bodies were formed of exudation material and blood collected beneath the epithelium, and were not simple retention cysts due to the closure of mucous glands in the mucosa of the ureter.

Alsberg,[*] some years ago, also operated upon a case of renal lipoma by removing the right kidney, enlarged to the size of a child's head, supposing it to be malignant, from a woman aged forty. The kidney was found to contain a large number of the lipomata and fibro-lipomata, varying in size from a millet seed to a walnut. P. Weber, who has investigated the subject, believes Alsberg's and Warthin's cases to be the only instances in which a surgical operation has been required on account of renal lipomata.

* *Archiv f. klin. Chirurgie*, Berlin, 1892, vol. xliv., p. 458.

ANGEIOMA.

It has been questioned whether angeioma ought to be in-
cluded amongst tumours of the kidney; whether it is anything
more than a "vascular ecstasis." It is customary, however,
and there are good reasons for so doing, to regard it as a dis-
tinct formation, or new growth, of reticulated cavernous tissue.

True angeioma, or simple nævus, is very rare. In structure
it is practically the same as the cavernous angeioma or erectile
tumours of the liver and parotid. It may or may not be en-
capsulated; it is usually of a bright red colour; it varies in
size from a cherry-stone to a walnut, and is situated either in
the medullary substance or immediately beneath the capsule.
Though called a tumour, the surface of the kidney over the
angeioma and the parts around it may be shrunken rather than
prominent or enlarged.

A simple angeioma may have a clinical importance as well as
an anatomico-pathological interest. In a case in which I was
consulted in 1897 severe intermittent hæmaturia as well as
slight pyuria was present. A young woman, aged twenty-three,
was taken ill with swelling of the cellular tissue about the trachea,
superficial ulceration over each vocal chord, and suppurative
cellulitis of the right leg. She had at this time profuse hæma-
turia and slight pyuria, with left lumbar pain; and she gave
the history of having had previously, over a period of some years,
several attacks of hæmaturia, with pain in the left loin. Each
attack lasted on an average for from three to four days. She
died with symptoms of septicæmia eleven days after the onset
of the cellulitis. On the day of her death she was comatose,
and passed very little urine. Her temperature at death was
107·4. At the post-mortem examination the cause of the hæma-
turia turned out to be multiple angeiomata in the left kidney,
one of which had ulcerated into the upper calyces. This kidney
weighed eight ounces; its pelvis contained some blood; there
was no calculus, though one had been suspected; the ureter
was normal. The renal tissue in the neighbourhood of the
ulcerated calyces showed a peculiar plexiform arrangement of
vessels like an angeioma. There were areas of red spongy tissue
in the renal substance, all in the medullary rather than in the
cortical structure of the organ. They had extended into the

kidney between the papillæ, thus following the course of the vessels. To the naked eye the angeiomata had no distinct capsule, and their cut surfaces showed the open mouths of two or three large vessels, with a wide zone of cavernous tissue surrounding them. Microscopically, these areas were composed of a collection of vascular spaces, as in an angeioma. The walls of the spaces were composed of muscle tissue, without elastic laminæ, and resembled venous channels. Some of them, however, seemed to be mere spaces in fibrous tissue. They were mostly filled with red and white cells; very little fibrin was discoverable. In one part there was some extravasated blood, and much granular matter, probably old clot. There were no signs whatever of malignant disease. The cortex of the kidney showed some interstitial thickening, but the glandular tissue was normal except for post-mortem change. The right kidney weighed eight and a half ounces; it was in a state of interstitial nephritis; its pelvis and ureter were normal.

Angeioma must not be confused with simple hæmorrhage, nor with the hæmorrhagic forms of cystic adenoma or sarcomatous teleangeiectasis.

Allen and Cherry,* in their exhaustive account of the histology of twenty-nine cases of primary neoplasms in the kidney contained in the Pathological Museum of the University of Melbourne, remark: "True angeioma of the kidney may show all grades of capillary dilatation until networks of inter-communicating vascular spaces are formed. In the neighbourhood of a simple angeioma the epithelial cells of the renal tubes may be active, with deeply staining nuclei."

Rolleston and Kanthack† have described a peculiar form of vascular growth which they met with in the left kidney of a man (sixty-two) who died of epithelioma of the lower part of the pharynx. Projecting from its convex border, and embedded in the kidney, was an irregular lobulated tumour about the size of a walnut. On section, it was very vascular to the naked eye, and from the large quantity of blood in it it was thought to be a cavernous angeioma. It was marked off from the renal parenchyma by a capsule, which was not adherent to the renal capsule. The structure of the tumour suggested convoluted and straight tubules

* International Medical Congress of Australasia, Fourth Session, 1897.
† *Journal of Path. and Bacteriol.*, 1894, vol. ii., p. 80.

of the kidney, which had been distended by circulatory blood derived from the capillaries of the Malpighian tufts, and not a new growth.

In parts of the tumour the remains of a few Malpighian bodies were made out. The epithelium lining the inner surface of Bowman's capsule contained large fat globules, while the epithelium covering the capillary tufts was unchanged. Fat globules were universally present in the epithelium lining the spaces and tubes throughout the tumour, whether collapsed or distended with blood, while the remainder of the kidney showed no marked degeneration.

LYMPHANGEIOMA,

which is very rare, consists of small, soft nodes of connective tissue limiting small cavities filled with pigmentary and fatty granules ; such growths have been described by Heschl,* but have been placed by Klebs † among the adenomata.

MYXOMA.

A case of pure myxoma of the kidney has been described and illustrated by Bezold. He found several small, opalescent, bluish-white nodules of mucous-like tissue in the cortical substance of the kidney. Hollen, in an inaugural address (Greifswald, 1890), mentions a case in which a pure myxoma was situated on the level of the hilum of the kidney. Tuffier speaks of having seen a case in which the tumour followed a calculous pyelo-nephritis : the patient died without metastases. In a man, aged thirty-nine, who was a patient in the Middlesex Hospital, simple myxoma rapidly developed into a large tumour, causing death within a year from the first discovery of the swelling. The symptoms were merely those due to pressure, wasting, and pain ; there was no hæmaturia, nor was there any metastasis. Myxomatous changes occur in tumours of other kinds, and myxo-sarcoma sometimes occurs in the kidney.

* *Arch. Général de Méd.*, 1866, F. ii., p. 617.
† *Handbch. der Path. Anat.*

CHAPTER XXI.

TUMOURS OF THE RENAL PARENCHYMA.
(*Continued.*)

(C) CYSTS OF THE KIDNEY.

THERE are several forms of cysts in the parenchyma of the kidney:

1. The small and numerous cysts which occur in granular kidneys, and which are of pathological rather than clinical importance. They never give rise to tumour, and are not amenable to surgical treatment. They present in the form of small vesicles, from the size of a pin's head to a small cherry or larger. They may be few or numerous. They are seen upon the surface of the organ, projecting slightly, as minute cysts with clear contents and very thin transparent walls; or, upon section of the organ they may be seen deeply within the cortex in the zone between the cortex and the pyramids, or even in the medullary part itself. The cysts within the organ are smaller than many of those near the surface. The fluid within these cysts is yellow, clear, limpid and serous, not urinous. They result from the compression and constriction of urinary tubules due to the sclerosis which follows interstitial nephritis. They are, in fact, obstruction or retention cysts.

2. Dermoid cysts. Such cases occur in animals. There is a specimen in the Hunterian Museum containing wool rolled up with oil and fatty matter. It was removed from the body of a sheep, and was occupying the natural position of one of the kidneys, which was deficient. I personally have not met with any instance of such a cyst in the human body. Though included in the classification of the Liverpool committee,* no specimen came under the direct or indirect notice of the gentlemen who formed that committee. Cases have, however, been recorded by Paget, Madelung, Walker, and Biggs.† In Walker's case there were three dermoid and several serous cysts present. In Biggs's case the

---

* *See* Mr. Paul's paper, *Brit. Med. Journ.*, Jan. 12th, 1884.

† *New York Path. Soc. Trans.*, lxxxviii.

kidney was small, with six or seven cysts varying in size from a pea to a filbert, containing fatty pasty matter composed of cholesterine crystals, fat globules, epithelium and granular corpuscles. A doubtful case was recorded by Jackson,* which however may have been a dead hydatid cyst or a changed tuberculous kidney. The cyst was removed from a woman aged seventy-seven who died of cancer of the uterus. It measured six by three and a half inches, was entirely cretaceous, and contained a material like plaster-of-Paris mixed with water and about to set. This material consisted of carbonate and phosphate and oxalate of lime in about equal proportions, with a little carbonate of magnesium and triple phosphate.

3. Simple cysts.

4. Conglomerate cysts, polycystic disease or cystic metamorphosis of the kidney. This form of disease is sometimes congenital; sometimes found in adults. The kidneys thus affected are occasionally of great size, and present themselves as abdominal swellings.

5. Hydatid cysts.

6. Paranephric cysts, or cysts which are external to the capsule, and formed in the circumrenal fatty tissue, but which are intimately adherent to the kidney, and sometimes communicate with the renal cavity. They are indistinguishable in their clinical aspects from some of the cystic formations of the kidney itself.

SIMPLE OR SEROUS CYSTS.

Distinct from that form of cystic distension of the whole organ which results from obstruction in the ureter, and which is commonly known as hydro-nephrosis; distinct also from that rather rare form of disease in which the whole kidney is converted into a mass of conglomerate cysts; and distinct, too, from the cysts of small or microscopic size met with in great numbers in the "granular kidney," there are simple cysts frequently seen in the kidneys of elderly people, one or more of which may attain considerable size, and so constitute a disease of great importance (Figs. 98, 99, 100).

In the Museum of the Middlesex Hospital are some beautiful specimens of this form of cyst, though none of them is, perhaps, of a size to have formed a very noticeable tumour during life. In the Hunterian Museum there are three specimens of this sort,

* *The Boston Medical Journal*, April, 1874, p. 408.

and the *Transactions* of the Pathological Society of London contain scattered through the volumes the records of some cases.

Simple cysts cause no symptoms except those due to their size; probably not one-fourth of them reach a size large enough
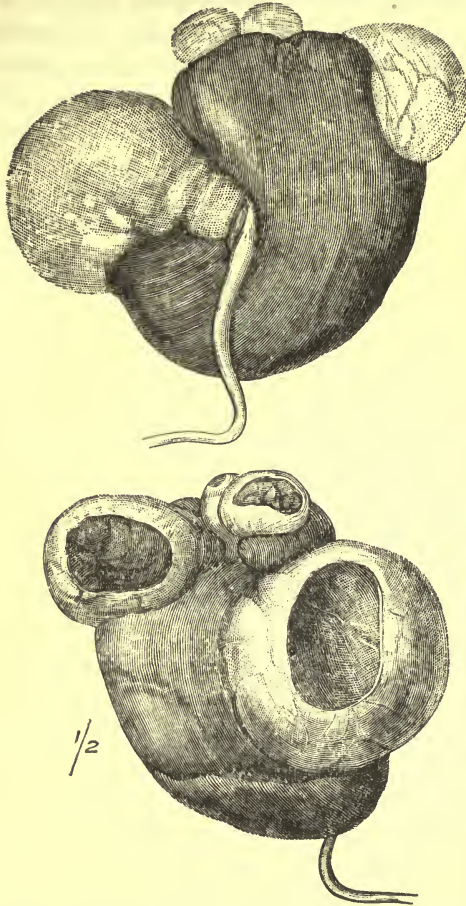

Fig. 98.—Two views of a Kidney containing Blind Serous Cysts.
(Middlesex Hospital Museum.)

to attract attention during life; and not one-third could be detected if deliberately sought for by palpation.

Pathological anatomy.—These large cysts are frequently single, but one or two small cysts, or sometimes even many (as in Fig. 98), may be present by the side of the large one. They are met with in any part of the organ and upon either surface, but their

ordinary situation is at one or other end of the kidney. Their
form is round. The cyst wall, composed of connective tissue,
is smooth, thin, and transparent, and adheres so closely to
the renal tissue that it cannot be enucleated but has to be dis-
sected away. Its external surface is quite smooth, and its internal
surface is lined with tesselated epithelium. Occasionally the cyst
wall is of great thickness, semi-cartilaginous in places, or here and
there impregnated with salts ; or fibrous bands may project on its
inner aspect, and veins of varying size course beneath the mucous
lining. The cyst capsule, which bulges the renal capsule, is really
not formed by it, though it may seem to be so.

These cysts vary **in size** from that of a walnut or orange to
that of a large ovarian cyst. Newman states that there is in the
Museum of the Royal Infirmary at Glasgow a very large thin-
walled cyst which projects from the middle of the convex border
of the kidney ; the cortical substance is entirely and the
pyramidal portion in great part destroyed, and the cyst
almost extends to the renal pelvis but does not open into it,
the cyst cavity and the pelvic cavity being separated from one
another by a thin wall of renal tissue. Microscopically the rest
of the kidney proved to be healthy, except where more or less
altered by direct pressure of the cyst. In a case in his own
practice Newman found a large simple peripheral cyst, which
projected from the posterior aspect of the kidney, deeply indenting
the renal substance, so that its deepest part extended to the renal
pelvis, but did not open into it.

In a case which I saw in 1869–70 * the greater part
of the abdominal cavity was occupied by a large fluctuating
cyst, involving the lower part of the left kidney, which was
spread out in a thin layer over the attached part of the
cyst. The upper half of the kidney was normal, except for
a small nodule of medullary cancer. The ureter, with the
spermatic artery and vein, took a very curved course to the
bony pelvis along the back of the cyst. The fibrous capsule
of the kidney was continued over the cyst. In the ex-
panded portion of the renal parenchyma was a second small trans-
parent cyst the size of a currant. Some of the calyces were seen
to extend into that part of the kidney which was spread out
over the cyst, but did not communicate with it. The ureter in

* *Path. Soc. Trans.*, vol. xxii., p. 171.

the greater portion of its length was of normal size and closely adherent to the back of the tumour.   The cyst with its contents weighed sixteen pounds, and measured twenty-nine inches in one diameter and twenty-six inches in another.   It was filled with a dirty brown fluid, and discoloured blood-clot, looking like coffee-grounds ; much of the clot was deposited in layers on its inner surface, but there was also evidence of recent blood extravasation into the cyst cavity.   The cyst wall averaged about one-eighth of an inch in thickness, but was not uniform throughout, being in some
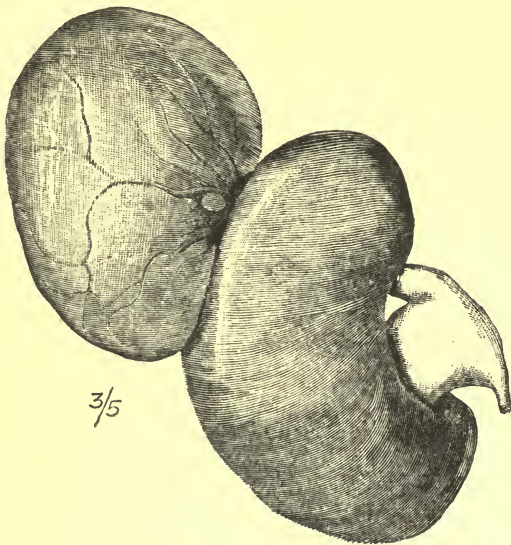

Fig. 99.—Large simple Cyst communicating with a Calyx of the Kidney ; the Renal Pelvis dilated.   (Middlesex Hospital Museum.)

places thinner, in others thicker.   Its outer surface was smooth, except where uncovered by peritoneum, and was marked by large veins meandering in it.   Branches of the renal artery and vein were traced into its walls.   The presence of the cancer was a coincidence, and had nothing to do with the etiology of the cyst.

The sizes of the cysts in the Hunterian Museum are respectively six, four, and three inches in diameter ; two of them occur in granular kidneys ; one has associated with it a few others, of the same kind, but only a line or two in diameter.   The largest cyst is situated on the outer aspect of, but deeply embedded in, the kidney ; the others are on the anterior surface close beneath

the capsule, and more or less coalesced with it. Of eight cases
of cystic formations in the kidney met with in 2,610 post-mortem
examinations at the Middlesex Hospital, five were single cysts,
and three were specimens of large cystic degeneration in the adult.
In one of the five cases of single cyst the tumour was as large
as a Tangierine orange, had very thin walls, and sprang from
the lower end of the kidney ; in another the cyst, filled with
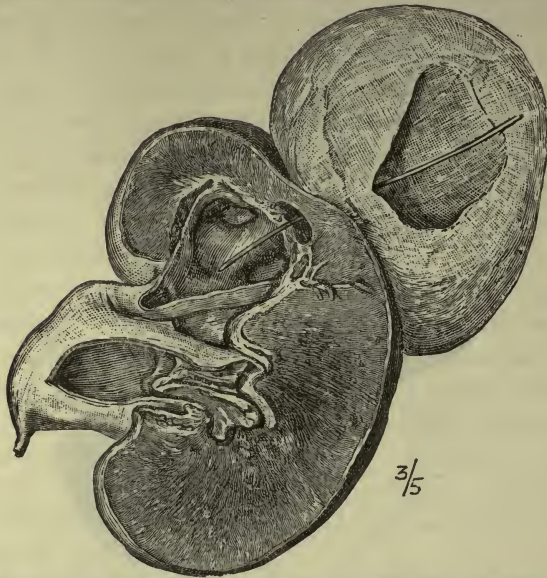serous fluid, grew from the upper end of the organ, and was

Fig. 100.—View of the same Kidney and Cyst in section. (Middlesex
Hospital Museum.)

the size of a medlar ; in the third it was situated at the upper
end of the right kidney, and the left kidney was granular and
had small cysts in it ; in the fourth the cyst grew from the lower
part of the left kidney, had calcified walls and gelatinous contents,
and was of the size of a horse-chestnut ; in the fifth case each
of the kidneys had a single cyst, each the size of an olive, and filled
with clear brown fluid. The ages of these patients were forty-nine,
fifty-five, fifty-nine, nineteen, and sixty-one. All died of causes
independent of the kidneys. In another case in which the pelvis
of the kidney of a woman aged seventy-five was dilated owing to
a block in the ureter from new growth secondary to carcinoma

of the bowel, there was behind the kidney a paranephric cyst the anterior wall of which was formed by the kidney capsule and the outer and posterior walls by the condensed connective tissue. There was a small communication between the cyst and the dilated renal pelvis.

These simple cysts **arise** in the cortex of the organ, and project in relief from its surface. As they grow they tend to spread out the renal substance, so that a large part of the kidney may be stretched in a thin layer over the base of the cyst wall. The rest of the kidney will be healthy and functionally active, or it may be granular, or more or less atrophied from the pressure of the cyst itself. Sometimes a communication is established between the cysts and one of the calyces of the kidney (Figs. 99 and 100).

The **contents** of the cysts are generally a clear, colourless, or straw-coloured fluid, containing a small quantity of albumen and a little saline matter, but rarely, if ever, anything more than the merest trace of urea or other special urinary ingredients. Rokitansky was never able to discover in them even a trace of urinous precipitates or concretions. Dr. William Walter * records a case of cystic tumour in a floating kidney, for which nephrectomy was performed. The cyst contained ten ounces of a pale, straw-coloured fluid, of specific gravity 1,013, holding two-fifths albumen ; it was not urine. The walls of the cyst were very thin and tense, and of transparent bluish hue. In Mr. Cæsar Hawkins' case of " aqueous encysted tumour " of the kidney the transparent fluid of the cysts contained no albumen, which suggested its possible hydatid nature ; but Dr. Prout wrote of it, " The fluid is *serous ;* I have not detected anything urinary in it." †

Hæmorrhage may take place into the cyst cavity either as the result of injury or of extravasation from one or other of the veins, often quite large, which ramify in the cyst walls.

If hæmorrhage has taken place the fluid will, of course, have a sanguineous colour and character. Very often some of these cysts contain a thick jelly-like matter, like thin glue, and others a nearly solid substance which resembles the colloid material found in other parts of the body. Cholesterine is sometimes present, especially in cysts which contain blood-stained fluid.

* *Brit. Med. Journ.*, Sept. 29th, 1883.
† *Med.-Chir. Trans.*, vol. xviii., p. 186.

Rokitansky once found such a cyst of considerable size, seated at the circumference of a kidney, inflamed and ruptured, its contents having escaped into the surrounding adipose tissue.

Pathogenesis.—The origin of these cysts is uncertain; possibly they arise from the conversion of the cellular layer in the Malpighian corpuscles into serous cysts, or from the dilatation of tubes or Malpighian capsules, or perhaps from vacuolation of epithelium. The following questions arise concerning them : (1) Are they retention cysts consecutive to sclerosis of the inter-tubular tissue following chronic interstitial nephritis, or are they truly new formations ? (2) Do they arise from the convoluted tubules or from the Malpighian capsules ?

But however these questions may be answered, we know that the fluid contents of cysts of different origin, and even of varying microscopical structure, may be physically and chemically alike.

Etiology.—It is stated by some writers that the large simple cysts are much more frequent in women than in men. Tuffier gives the proportion as twenty to three. In the only two cases recorded by Newman the patients were males, aged respectively sixty-one and forty-nine. In the remarkable case which I published many years ago in the *Transactions* of the Pathological Society the patient was a male aged sixty-nine. In the five cases referred to above collected from the Middlesex Hospital post-mortem records three were in men and two in women.

These cysts occur in either kidney alike, but are rarely bilateral. They affect persons in middle and advanced life. They are probably in every instance due to localised obstruction special to the tubule or tubules in which the cyst originates. Whatever may be the cause, intra-tubular or peri-tubular, congenital or acquired, traumatic or inflammatory, and whether it be blood-clot, tube-cast or calculus which obstructs the tubuli uriniferi, the secretion accumulates behind the obstruction and distends the Malpighian capsule or tubule, as the case may be, until a thin-walled cyst is developed. It is probable that in some of the cases several tubules are obstructed, and that the resulting cysts break into each other and then expand as a single cavity.

Symptoms.—Simple renal cysts commence insidiously, grow slowly, and, as a rule, do not attain to a size sufficiently great to give rise to a *tumour* which can be discovered by palpation.

When of such a size as to be detected clinically they present
themselves first in the loin or in the lumbar area of the
front of the belly, and may be so hard at first as to be mis-
taken for solid growths; or they may fluctuate, give a dull note
on percussion in the loin, and if the cyst be situated on the
posterior aspect of the organ the kidney may be felt to be well-
defined and movable on the front aspect of the swelling.   In
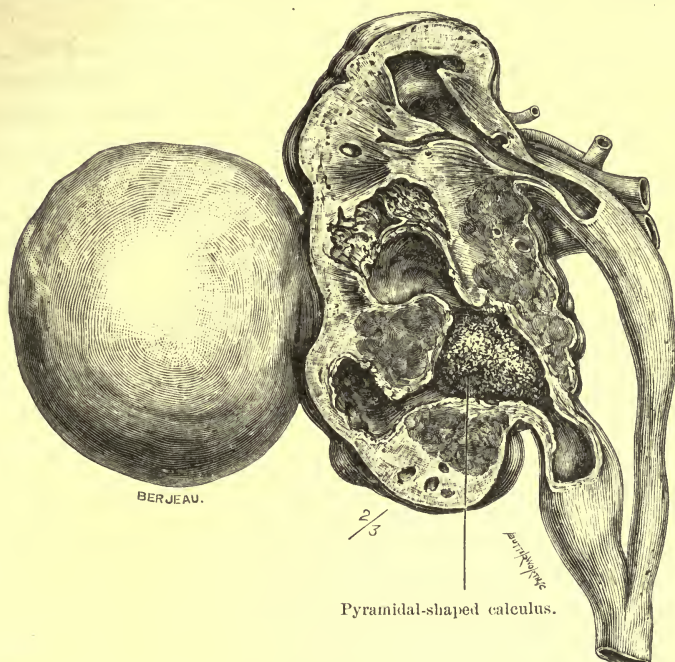

BERJEAU.

$\frac{2}{3}$

Pyramidal-shaped calculus.

Fig. 101.—Kidney with a Double Ureter and Double Pelvis. A cyst the size of
an orange projects from the outer border of the kidney and a few small
cysts are scattered through the renal substance. A pyramidal calculus
occupies the lower renal pelvis. (St. Thomas's Hospital Museum, No. 2110.)

some cases the tumour moves with the kidney, and if at the
same time fluctuation is detected the diagnosis will probably be
" hydro-nephrosis in a movable kidney." As the cyst increases
it may gradually monopolise the greater part of the abdominal
cavity; if it does so, its point of attachment ceases to be even
approximately ascertainable; in the female it may give rise to
the idea of ovarian tumour. *Pain* may follow the formation
of a tumour, and may even, though much more rarely, precede it;
it is of a dull aching character and gives rise to a sensation of

VOL. I.—²P

weight limited to the loin and hypochondrium; at times, especially after much exertion, the pain may be more severe.

The *general* symptoms which may be met with are sickness after food, weakness and inability to work; cardiac weakness has been noticed. The urine usually remains regular in quantity and normal in amount. Emaciation, increasing debility, and at last utter prostration may mark the growth of a cyst to a great size.

Diagnosis.—The difficulty in the diagnosis of these cysts will be apparent from the reports of such cases as those recorded by the author * and Dr. Bristowe.† The symptoms excited are merely those of pressure, and are therefore not unlike the symptoms of other abdominal swellings. The locality of the tumour in its earlier stages will somewhat aid the surgeon in correctly judging of the organ affected; but not even then in estimating precisely the character of the swelling. In Bristowe's case, in its symptoms, position, and cure by repeated tappings, the tumour resembled some of those false cysts which are formed by adhesions after rupture of the kidney (or liver ‡) and which have been described in previous sections. My own case in its early days was most like one of solid tumour in the abdominal walls, and afterwards, like Bristowe's, might have been mistaken for ovarian disease had the patient been a woman. The relative position of bowel to ovarian cyst, as compared with that of bowel to renal tumour, would not have assisted a differential diagnosis in either instance. Nor did the character of the urine. Bristowe, in the same number of the *Lancet,* recorded another case which simulated his first case, but which on post-mortem examination turned out to be a round-celled sarcoma growing from among the pelvic viscera and containing a large hæmorrhagic cyst. The cyst was tapped five times, fluid of a reddish-brown colour, alkaline reaction, and specific gravity 1024, being drawn off in quantities varying from 74 to 167 ounces.

Adenomata and other new growths of the kidney have a tendency to become cystic, the cysts in some instances attaining

* *Trans. Path. Soc.,* vol. xxii., p. 171.

† *Lancet,* May 5th, 1883; and previously published in *St. Thomas's Hospital Reports.*

‡ *See* article by author in Ashhurst's "International Encyclopædia of Surgery."

a great size, whilst the proportion of solid new growth is very small indeed. It is thus impossible without a careful microscopical examination of the cyst wall to be absolutely certain of the true nature of the cyst. The histological characters of the tissue spread out upon the attached part of the wall of a simple cyst are those of normal renal tissue, or renal tissue but slightly sclerosed as well as compressed.

Thus the difficulties which surround the diagnosis of these very rare cysts are extremely great; for not only may they be mistaken for hydatids of the kidney, for hydro-nephrosis, and other renal tumours and perinephric fluid collections, but it is moreover almost impossible, after using every care in examination, to distinguish them sometimes from solid tumours in the parietes; sometimes from hepatic or splenic cysts, or cysts of the omentum, mesentery, or pancreas; sometimes from malignant cystic tumours springing from the pelvis or elsewhere within the belly, and sometimes (indeed generally, in their later stages) in the female from ovarian cysts.

Prognosis.—The growth of these cysts is always slow, and it is only by their size and the compression effects which they cause when of great dimensions that they are injurious. They compress, and tend to produce sclerosis of the renal parenchyma, and for that reason their removal is a matter of importance. If removed when small or of but moderate size, the kidneys from which they arise will probably be left unaffected.

Treatment.—The treatment by puncture, recommended in the earlier days of renal surgery, should no longer be employed. As a means of diagnosis between simple serous cysts and simple chronic hydro-nephrosis puncture is useless, although it would probably enable a hydatid cyst to be diagnosed from the other two forms of enlargement just mentioned. As a method of treatment it is uncertain, and not free from risks; and if the cyst refills again and again, puncture, though ultimately successful, is unnecessarily tedious. It has been employed with success for simple serous cysts as for hydro-nephrosis; but it is not to be compared with incision and drainage, or with excision—being so often followed by reaccumulation of the contents of the cyst. Partial and total nephrectomy have been employed, but ought to be reserved for cases in which the cyst is of voluminous size and has in great part destroyed the renal tissue.

For cysts of moderate size, especially when situated at one of the extremities or in the posterior surface of the kidney, the most perfect and satisfactory plan is that which Tuffier and Bardenheuer have practised in one case each, namely, the excision of the cyst from its renal couch through a lumbar incision. These cysts will not readily shell out, as does an adenoma from the thyroid for instance, but require to be dissected away. This
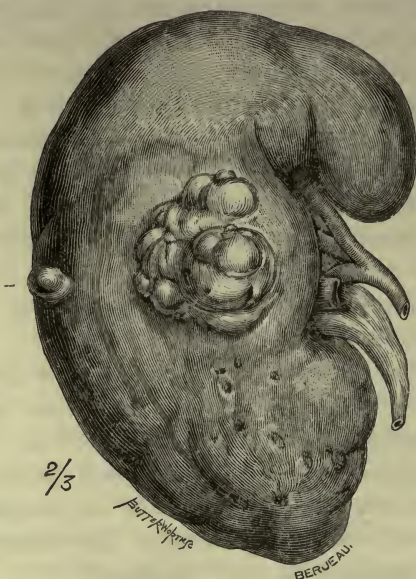

Fig. 102.—Cyst of the Right Kidney, from a man æt. 76. There was cirrhosis of the liver, with jaundice. The cyst, which was not connected with the renal pelvis, contained two ounces of dark green turbid fluid. (Middlesex Hospital Museum.)

can be done without removing any, or at most but the smallest quantity of renal tissue. It leaves, however, fresh-cut surfaces in the kidney tissue of greater or less depth dependent on the degree of penetration of the cyst; these surfaces should be brought into apposition by means of fine silk or catgut sutures as after removal of a wedge of renal tissue for tubercle or new growth. Tuffier's case was quite successful, but Bardenheuer had to perform nephrectomy upon his patient five days later because of septic infection of the kidney. This plan is, I consider, preferable to primary nephrectomy for cases in which there are one or perhaps two cysts of moderate size, even if several others

of minute size are studded about within the renal cortex, as is seen to be the case in Fig. 102.

Another plan is to expose the cyst through a lumbar incision, and, after emptying it and cutting away all the projecting part of the cyst wall, to stitch the shortened edges of the part still connected with the renal parenchyma to the deep layer of the lumbar fascia after destroying its secreting surface with pure carbolic acid or nitric acid. A small drain tube should be retained for a few days, and the rest of the wound in the lumbar parietes should be closed by sutures.

A third plan for cysts of large size is to cut down through the linea semilunaris upon the front or side of the tumour, and, after drawing off the fluid contents, to incise the wall of the cyst and stitch its cut edges to the cut edge of the abdominal parietes, and then drain the cyst cavity. This treatment leads to subsequent contraction and in some cases to complete obliteration of the cyst either by adhesion of the collapsed surfaces or by granulation after suppuration. It, however, cannot be recommended. Five cases at least have been so dealt with under the impression, formed before the operation was commenced, that the tumour was ovarian. All the patients recovered, but a fistula followed in three of them. If a fistula should remain and prove troublesome, the question of nephrectomy may be considered ; but it must be borne in mind that the kidney structure in these cases is functionally useful, and therefore the organ ought not to be sacrificed without specially strong reasons.

Primary nephrectomy for removal of the cyst may be necessitated by the great size and pressure effects of the tumour and the relations of the cyst to the renal parenchyma and renal vessels, large branches of which sometimes run into and spread over its walls. Tuffier has collected thirty-one cases in which ablation of the kidney with the tumour has been performed, seven times by the lumbar method with a mortality of 11 per cent., and twenty-four times by the trans-peritoneal method with a mortality of 40 per cent. Nephrectomy must be avoided when possible.

Partial nephrectomy should be performed when the cyst is situated at one pole of the kidney and a considerable part of the renal parenchyma is spread out over the cyst wall, and if the large renal vessels can be left intact.

THE LARGE POLYCYSTIC KIDNEY.

" The large polycystic kidney " has been described under a variety of names, such as " cystic disease," " conglomerated cysts," " congeries of renal cysts," " cystic degeneration of the kidneys " (Rayer), and " cystic metamorphosis or transformation of the kidney " (Cruveilhier). I shall use the term " the large polycystic kidney," rather than that of " cystic disease," which is more generally employed by English authors, because the latter seems to me in a way to prejudge the nature of a lesion which is still but very imperfectly understood. Moreover, the term "cystic disease " is often used indifferently for a number of cystic states of the kidney, and if employed at all had best be kept as a general title to embrace the entire group. The cases of multiple small cysts which occur in ordinary chronic interstitial nephritis, and the large simple serous cysts previously described, as well as the cysts of parasitic origin, are excluded from this class of " large polycystic kidneys."

Pathological anatomy. — In the lesion now to be considered the whole kidney is converted into a vast number of conglomerated cysts of varying size, which leave unchanged scarcely any (if any) portions of the glandular structure, and give a greatly increased bulk to the metamorphosed organ. Sometimes the cystic organ is ten times as large as the normal kidney.

The shape of the kidney is fairly well retained by the enlarged mass, which often weighs a pound or two, sometimes five or six pounds ; and in Dr. Hare's case (probably the largest on record) the left kidney measured fifteen and a quarter inches in length and weighed sixteen pounds, the right kidney being double its normal weight.

The medullary and cortical portions are alike replaced by the cysts which bulge the capsule and protrude on the surface as oval or circular translucent sacs (Figs. 103 and 104). The cysts vary in size from microscopic minuteness to the dimensions of grapes or walnuts, the largest being often in the centre of the organ. In Dr. Hare's case one of the cysts held half a pint of fluid.

Contents of the cysts.—The cysts contain different coloured fluids—clear, pale straw coloured, deep yellowish, purplish, or deeply blood stained. These variously coloured contents are either

serous, limpid, and transparent ; or viscid, turbid, treacly, colloid, or pea-soup like; or caseous, and sometimes even almost solid. Occasionally they are purulent, as in the case reported by William F. Farr* which occurred in a woman aged fifty-three, who for seven years had suffered from rigors and fever.   The contents of the cysts are acid or neutral in reaction, and consist of a large quantity of albumen, some urea, a variable amount of triple phosphates, molecules of fat, epithelium, crystals of cholesterin and of uric acid, blood corpuscles, and occasionally leucin.   The colloid material in the smaller cysts is homogeneous, in some of the larger cysts it is disposed in concentric layers.   In certain of the medium sized cysts may be found little connective tissue vegetations covered with several layers of epithelium resembling the papillary proliferations in ovarian cysts.   Ritchie states that there are diverticula containing renal elements—tubules and blood vessels projecting into cyst cavities.   The cysts do not communicate with the pelvis or calyces, but often with each other.   They are closed cavities whose walls are excessively thin, composed of connective tissue and lined by a delicate layer of cubical or pavement epithelium.   The original renal substance is atrophied and in some places wholly removed, in other places portions remain unchanged between the cysts ; and in other places, again, around, between, and even at a distance from the cyst wall, the renal tissue is sclerosed, and the arteries show signs of endarteritis and periarteritis.

The connective tissue varies in amount in different cases, and may be either very fibrous or hyaline.   In most there is an increase, and in very advanced cases the increase may be considerable.   Leucocytes and increased numbers of connective tissue corpuscles are seen even at a distance from the cysts, giving evidence of local irritation.   All stages of changes are to be seen in the tubules and Malpighian capsules, from slight dilatation to actual cyst formation.   In some of the capsules the remains of the glomerulus may be detected.   The epithelium is undergoing degenerative changes, the nuclei are shrivelled or absent and stain badly, and large epithelial shreds become detached from the walls of the cysts during the process of preparing the specimens.

The perinephric tissue has in a small number of recorded cases been the seat of abscess, but when this is the case there

* *Amer. Journ. Med. Sciences*, vol. ciii., p. 277 (1892).

has been usually suppuration in some of the cysts also, one or more of which have broken on the surface of the organ. The kidney by its weight sometimes becomes displaced, and in many cases is very mobile.

Sometimes the renal pelvis, but not the ureter, is much dilated.

Fig. 103.—Polycystic Kidney ; the left half seen in section, and the right half on its outer surface.   (Middlesex Hospital Museum.)

The dilatation is due to dragging, not to obstruction.   In one of my cases the pelvis was enormously dilated.

One of the most important features of the disease is that both kidneys are commonly affected. Dickinson found only one case out of twenty-six in which the disease was confined to one kidney. Lejars, out of sixty-two cases in the adult, found only one case which was unilateral, and in that case there was a round cystic space the size of a penny piece in the cortical substance of the other kidney.*   Four out of the seven cases in which

* See Hogg, Trans. Path Soc., 1860, and Lejars' case, 21.

I have operated were unilateral. It is rare for the lesion to be equally advanced in the two organs.

Bristowe,* Wilks, Pye-Smith, and I have described cases in which the "large polycystic kidney" has been associated in the same person with cysts of a similar nature in the liver or spleen. Pye-Smith's † case was one of cystic disease of the liver and of both kidneys in a man, aged fifty-three, who died of pulmonary gangrene, and to his description of the case he added a summary account of the other published cases, commencing with Bristowe's. Lejars has collected fifteen other cases in the adult in which the liver as well as the kidneys of the same individual was the seat of cystic degeneration. He includes Bristowe's and Pye-Smith's cases in his observations, and thus found seventeen out of sixty-two in which the liver was involved. Ritchie states that on post-mortem examination of eighty-eight cases, both kidneys were found polycystic in all but two. In twenty-one cases the liver was cystic, and of these it is noted that in one case the thyroid, in one the uterus, and in one the ovary was also cystic. In other cases the ureters and bladder were also affected with cystic disease. Cystic disease of the liver is but seldom found associated with "congenital cystic kidney." In thirty-five cases of cystic disease of the liver associated with cystic kidney collected by Still,‡ only three occurred in infancy. Still's statistics show that this associated condition is more common in women than men, for out of twenty-eight cases in which the sex was recorded, twenty-one were females and seven males, thus making the proportion of females to males three to one.

According to Wilks and Moxon, the cysts are an excessive production of that minuter cystic condition of the kidney which we have already referred to as occurring in granular kidneys; and as with granular kidneys, so with the large cystic kidney, *hypertrophy of the heart* is not unfrequently associated. In one of my cases the left ventricle of the heart was much hypertrophied, the right kidney alone being converted into a congeries of cysts, the secreting structure almost gone, and the pelvis enormously dilated; the left kidney was large and granular, had a wasted cortex, and was puckered in places on the surface. Newman found hypertrophied heart recorded in 60 per cent. out of 105

* *Path. Soc. Trans.*, vol. vii.
† *Ibid.*, vol. xxxii., p. 114.
‡ *Ibid.*, 1898.

cases which he collected, and the arteries atheromatous in 15 per cent. Newman has also observed cystic kidney coincident with malformations of the aortic valves and of the septum ventriculorum. He considers the congenital theory of the origin of this affection in the adult is supported by the co-existence of such deformities.

" Congeries of renal cysts " sometimes lead to enormous abdominal distension of the fœtus *in utero*. Parturition is thus occasionally rendered difficult, or even impossible, and the child, when born, presents the appearance of one having an ovarian cystic tumour. Cystic degeneration with abdominal distension is even a cause of death of the fœtus *in utero*, or during parturition. It is sometimes found associated with various malformations such as talipes, cleft palate, and imperforate anus.* I have the notes of a dissection made by an old pupil (Mr. John Palmer) of a child born at the eighth month, and which lived five hours. Both its kidneys were wholly composed of cysts ; and the anus, rectum, urethra, and external genital organs were absent. The bladder was misplaced and malformed, the sigmoid flexure was malformed, the uterus was arrested in its development, and the outlet of the pelvis was smaller than natural. Drs. Lever and Duffey and Prof. Virchow have described cases of the sort. The absence or malformation of the renal pelvis and of the ureter has also been found with fœtal cystic kidney.

These cases are also considered to support Küster's view, which is that the lesion is caused by abnormal development, such as the absence of renal calyces and pelvis, and in many cases of the ureters also. Commandeur has cited a case of congenital cystic kidneys associated with bilateral hydro-nephrosis due to (congenital) valvular stricture of the urethra : the bladder was hypertrophied and but slightly dilated, but the ureters and kidneys were enormously distended. No other malformation was present.

Pathogenesis.—Numerous theories have been evoked to explain the development of this disease, and the greatest diversity of opinion exists amongst pathologists. For a very excellent historical sketch of the literature of the subject, together with an epitome of the several theories which have been held, the reader is referred to a report by Dr. James Ritchie in the fourth volume of the *Laboratory Reports*, issued by the Edinburgh Royal College

* *Transactions of London Obstetrical Society; also Proceedings of Medico-Chirurgical Society* for 1876 (Lond.).

of Physicians. From that report the following account is in large part drawn :—

1. One of the theories of the cause of this affection is that which ascribes it to the *included remains of embryonic life, i.e. to persistent germinal rudiments.* In this country Shattock is the most definite in his statements that there are retained remains of the Wolffian body—that there is a combination of mesonephros with metanephros, and that the cysts in the kidney are due to a late development of these rudimentary cells of the mesonephros. Newman, whilst admitting the origin from Wolffian remnants of cysts in the ovary and testis, states that such remnants have not been demonstrated in the kidney, though if they had been found it would be strongly in support of the embryonic origin of the large polycystic kidney.

Other theories of a congenital origin are (1) a malformation resulting from a failure of union of the excretory canals with the convoluted tubules, and (2) an excessive feebleness of the tubules which renders them incapable of bearing the normal intra-renal pressure : thus, Bard (of Lyons) compares the poly-cystic kidney with cavernous angeioma. In connection with the theory of congenital origin of the large polycystic kidney of the adult, there arises the question, " Is this affection related to ' congenital cystic kidney ' of the fœtus and new-born infant ? " I think it may be said without fear of contradiction that whatever may be the difference as to origin, there is at least no other essential difference between the polycystic kidney of the adult and the " congenital cystic disease."

2. Another theory is that there is a peri-tubular sclerosis with constriction of the tubules and backward dilatation of the tubules and Malpighian capsules : *that the disease is an essential part of cirrhosis.* Virchow holds that there has been a fœtal inflammation of the papillæ causing atresia of the papillæ, so that there is no communication between the urini-ferous tubules and the calyces of the kidney, and that the poly-cystic kidneys of the adult are only the consequences of the fœtal cystic state. Goodhart, Fagge, Bristowe, Wilks and Moxon consider it is consequent on cirrhosis; Kennedy thinks it due to interstitial nephritis occurring first and chiefly in the medulla. Beckmann, Rindfleisch, Juhel-Renoy, Paterson, Harley, and others believe it occurs in cirrhosis in consequence of strangula-

tion of the tubes by fibrous tissue. Others, connecting it with cirrhosis, state that it is induced by exudation into the tubules. Roberts held that it is due to strangulation of the tubes along with epithelial change; and Sabourin adds to this that it is related to adenomata. Many others also account for it by occlusion and isolation of portions of tubes which have not lost their secreting power.

Harley, Klein, and others regard the cysts as dilated Malpighian capsules. Others are of opinion that they are developed at the expense of the tubuli uriniferi. Simon and Bouillaud, whilst blaming obstruction of the tubules, think there is a rupture of the limiting membrane of the tubules, and the former regards the cysts as arising from extravasated epithelium and its parenchytic development, whilst the latter thinks there is a filtering of the retained fluid into the surrounding tissue; there is nothing, however, to support this theory.

3. A third theory, held by Dickinson, Cornil, Brault, Kiener, Kelsch, and Green, is that there is a local destruction of tissue, and that the cysts are centres of softening, or of degeneration related pathologically to fatty or colloid fatty change.

4. A fourth theory, which possesses great attraction for many is that the cysts are of the nature of a new growth. Hommey, Gombault, Lancereaux, Lejars, Brault, Malassez, Nauwerck, Sirleo, Weichselbaum, Greenish, Kahlden, Hufschmid, Brigidi, Severi, Goodhart, Saundby, and Bateman regard the epithelium of the tubules as the starting point and the disease as being of a true neoplastic nature. Some of these observers class the disease with the adenomata, some think it a fatty or colloid degeneration of adenomata, others hold that it is a gelatinous degeneration of the epithelium, and call it mucoid epithelioma.

Ritchie's view is that there is an irritative lesion leading to proliferation of epithelium and to connective tissue changes; that the irritation is propagated through the nervous system; that the cysts are formed from the pre-existing tubules and Malpighian bodies of the kidney; and that the disease is related to and should be studied along with the adenomata; that the cystic kidney is similar in character and origin to cystic liver; and that the large polycystic disease of the adult has no direct relation to congenital cystic kidney, which is due to an error in development.

The theories above referred to are not all inconsistent with

one another. Thus, the theory that cirrhosis is an essential part of the disease is quite consistent with that of local " destruction of tissue," or " centres of degeneration," the one leading to the other. Again, the epithelial changes which result in adenoma or mucoid epithelioma, may be caused by the strangulation of the tubes owing to sclerosis of the inter-tubular structures. We have also seen in previous sections how congenital malformations, as, for example, the inclusion of embryonic rests, and the failure of union of certain areas of the secreting with the carrying portions of the ·kidney, resulting in the functional isolation of these areas, may lead to adenomatous or epitheliomatous neoplasms which are prone to take on a cystic character.

But interesting from the pathological point of view as these various theories are, the practical outcome of a careful study of them, and of the differences and similarities in the histological characters of a large number of the recorded cases, leads me to the conclusion that the cysts in the congenital cystic kidney, as well as in the large polycystic kidney of the adult, are in all cases alike of the nature of retention cysts. Whatever may be the originating cause, whether congenital, such as intra-uterine papillary nephritis, congenital malformation, or included remains of embryonic life ; or acquired, such as sclerosis or interstitial nephritis, injury or impacted calculus ; whether there is a neoplastic formation of adenoma or epithelioma or not ; whether such new formations undergo fatty or colloid degeneration or not —in all cases the essential condition which determines the development of the cysts is obstruction. In some cases the obstruction may be due to strangulation of the tubules by fibrous proliferation around them ; in others to the exudation into the tubes of some material which blocks them—call it " solid albuminates " (Virchow) or " colloid " (Paget and Lancereaux), " epithelial and fibrinous " (Johnson), or what you will ; in others, again, the tubules may become functionally isolated as the result of cicatrisation after nephritis, or of a congenital defect due to the failure of union of the ·secreting with the carrying-off parts of the kidney ; but in all cases there is obstruction, resulting in cystic dilatation.

In Guy's Hospital Museum is a beautiful specimen of a large polycystic kidney with a renal calculus impacted in the upper end of the ureter (Fig. 104). Soller * recorded two cases of polycystic

* *Lyon Médicale*, vol. xxxv., p. 333 (1880).

kidney associated with traumatic obstruction; Littré,* a case in which the ureter was congenitally obstructed.

Obstruction (such as an impacted calculus) in the ureter or renal pelvis may cause either (1) hydro-nephrosis with polycystic kidneys, as in the case of Commandeur above mentioned; and in the
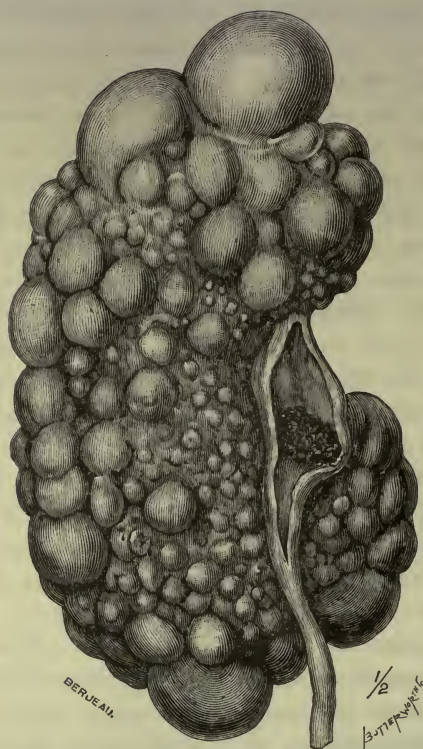

Fig. 104.—Cystic Kidney, with Calculus obstructing the Renal Pelvis.
(Guy's Hospital Museum, No. 1667.)

case reported by Farr of a suppurating conglomerate cystic kidney with hydro-nephrosis and obliteration of the ureter, in a woman in whose kidney was also a dumb-bell shaped calculus; or (2), as shown in Fig. 104, a polycystic kidney without hydro-nephrosis; or (3), as in Fig. 64 (p. 447) and Figs. 68 and 69 (p. 456), a sacculated pyo-nephrosis, with atrophy of the secreting substance, but no polycystic change. In other cases a more localised obstruction will lead to dilatation of one or two calyces with atrophy or cystic dilatation of the corresponding parts of the parenchyma.

* "Mém. de l'Acad. des Sciences," ann. 1705, p. 111.

The character of the distension from the same kind of cause will depend upon the situation of the earliest or the most intense obstruction. Take, for instance, a calculus in a calyx, or in the ureter : if the distension effects of the calculus are produced before secondary interstitial nephritis leads to obstruction in the minute tubules, then partial or general nephrectasis will result ; this is the common condition. If, on the other hand, cirrhosis from interstitial nephritis has led to strangulation of the tubules before the obstruction effects of the calculus came into force, then polycystic dilatation without nephrectasis may be expected. If obstruction in the tubules from cirrhosis is increasing at the same time as the obstruction in the renal pelvis or ureter is causing nephrectasis, then both polycystic disease and hydro-nephrosis may be found together.

M. Bar, on the other hand,* considers the sclerosis as only a secondary condition in the polycystic kidney. The pericystic sclerosis is for him only the evolution of the disease tending to a cure. He observed the polycystic lesion in the kidneys of three successive children born of the same mother, each of whom presented the cystic degeneration in a different degree. In the first child there was no sclerosis ; in the third, on the contrary, the sclerosis was ex-tremely marked. The kidneys of the second child showed the changes to an intermediate degree. In the third child the abdominal walls were wrinkled as if the kidneys, primarily large, had become reduced in size under the influence of the sclerosis.

Etiology.—Regarding as I do the congenital cystic kidney of the foetus and new-born, and the large polycystic kidney of the adult, as essentially the same disease, both being due to dilatation the result of obstruction, one must yet recognise different causes of obstruction in different cases—some congenital, some inflammatory, some malformation, some traumatic, some in the kidney, some in the ureter, and some in the urethra. The affection may commence *in utero,* or during the first few months of extra-uterine life, or in early childhood, or not until middle life or advanced or quite old age.

Out of eighty-eight cases collected by Ritchie the ages are given in seventy-five. The average for the seventy-five cases is 45·3 years, the youngest being twenty-three, the oldest eighty-eight. The youngest case in eight of my own was a man, twenty-one.

* *Ann. des Maladies des Organ. Génito-urinaires,* Juillet, 1899, p. 723.

In a case recorded by Talamon, the age is given as five and a half years, and a tumour had been noticed since the child had been six months old. Cruveilhier reports a case in a child of three years. In both these cases only one kidney was affected. Though alluded to by Ritchie, neither Talamon's nor Cruveilhier's case is included by him in his list of seventy-five cases. Lejars gives forty to fifty years as the mean age of the sixty-two cases collected by him, most of which are included in Ritchie's list.

Males seem to be somewhat more frequently affected than females, in the proportion of forty-five to thirty-seven according to Ritchie; of thirty-five to twenty-eight, according to Lejars; of sixty to forty, according to Newman who collected 105 cases. Michalowicz considers that malaria contributes in a distinct manner to cystic degeneration both of the liver and kidneys. In the case described by him, as well as one by Strubing, the patients had had several attacks of intermittent fever. Gout, rheumatism, the gravel, arthritic affections, tuberculosis, atheroma, and alcoholism have each been found associated with the disease, but are probably only indirectly related in a causal manner.

Polycystic kidney has been known to follow a natural labour in a mother of five children; it affected only one of her kidneys. There cannot be said to be more than a slight hereditary tendency to polycystic kidney. The three cases in the same family reported by Bar have been just referred to. A case is recorded in which it affected one kidney of a woman two members of whose family died of post-scarlatinal nephritis, and another child, a daughter, had a polycystic kidney. Dr. Savory of Bedford has recently given me notes of two children of a family of six, aged six and a half months and three and a half months respectively, in whom cystic kidneys (bilateral) were found after death, while of the four other children three showed other congenital defects and one was born dead. The father of these children was the only survivor of thirteen children born to his father and mother; of the other twelve one only lived five months, the remainder being born prematurely or dying at birth.

Symptoms.—The commencement of the disease is usually insidious: there may be no symptoms pointing to the kidney, or they may be masked, if any such exist, by others referred to some other organ. Ritchie states that seven cases out of seventy-eight were reported to have had no kidney trouble and

no evidence of illness, the kidney condition being discovered only after death. In exceptional cases the first indication has been uræmia, quickly followed by coma and death, the discovery of the condition of the kidneys having been a post-mortem surprise. As a rule the symptoms are somewhat the same as those of chronic Bright's disease, although there is seldom any tendency to dropsical effusions, and not rarely painful crises, not met with in chronic Bright's disease, occur simulating colic caused by calculus.

The symptoms may be divided into local and general. The local symptoms are pain and tumour. *Pain*, or a dull aching in the lumbar region, is commonly and early complained of, at first in one side, and later, if the disease becomes bilateral, in both sides. There may be pain referred to the abdomen as well as to the loins. It is of a sickening character but not severe except during the movements of the patient or the wandering of the kidney. Whilst resting in bed the pain is either absent or very slight. If the polycystic kidney is also movable, suffering is increased. The pain may be persistent or intermittent, or being persistent it may be exacerbated by attacks of great severity. The exacerbations may resemble renal colic, and while they last the swelling may increase and the general and urinary symptoms become worse. There may be tenderness on pressure, and in some cases even when only very slight pressure is used. In other cases there is only the sense of general discomfort due to the size and weight of the kidney, without any actual pain. Twenty patients out of seventy-eight complained of pain in the loins or in the abdomen.

Tumour.—Besides the two classes of cases above mentioned, (1) where there are no symptoms referring to the kidney, and (2) where uræmia comes on suddenly and is quickly followed by coma and death, there are two other classes of cases of the large polycystic kidney, (3) one in which the symptoms are simply those of chronic nephritis, and (4) the other in which, in addition to these symptoms, there is a more or less marked augmentation in the size of the kidney. Sometimes when the liver also is cystic there will be an increase in the size of that organ. In thin subjects the bossy surface of the kidney presented by the cysts may be felt.

A renal tumour on each side together with the symptoms of chronic nephritis may be looked upon as fairly pathognomonic

of polycystic kidney. A tumour, however, has been found in less than one half of the cases recorded (Newman), and a tumour in each flank, but very rarely. This is probably due to the fact that no attentive examination of the abdomen or loins was ever made in many of the cases, they being regarded throughout as cases of chronic Bright's disease.

In Lejars' list of sixty-two cases a tumour was present in only eighteen, and in only three of these was there a tumour in both flanks. In Ritchie's list of eighty-eight cases, a tumour was discovered in twenty-one cases, in eight of which there was a tumour in both flanks: in one the swelling presented in the epigastrium also, and in two other cases in the epigastrium only.

In four out of eight cases which have come under my own notice large tumours were present. In one case there was a tumour on each side.

When a tumour is present, percussion gives a dull note between the ribs and iliac crest, and from side to side to within three inches of the median line, or even less. The size of the tumour as detected by palpation may not correspond exactly with the dull area on percussion because the anterior margin or surface of the swelling may give a clear resonant note, and the percussion note may pass gradually from dulness into tympanitic resonance. The liver may obscure the percussion of the upper limit of the swelling, especially as it may be dragged down by adhesions, pushed down by tight lacing, misshapen, or enlarged by cystic degeneration or other cause. On the left side the spleen may interfere with the renal percussion above, and the crest of the ilium may interfere with the lower limit on either side.

Thus it is that the size of the swelling as detected by palpation may be either smaller or larger than the dull area elicited by percussion.

A feeling of undue resistance is given by the swelling even where the percussion note is resonant. By palpation sometimes the upper limit of the swelling can be made out when the liver or the spleen masks the percussion of the kidney, if the fingers are dipped beneath the lower edge of the organ and run upwards between it and the surface of the kidney. When the polycystic kidney is also movable it can be pushed out of its position, and when pressed towards the middle line, or when by change of the posture of the patient it falls in that direction, severe

sickening pain or actual nausea may be caused. In emaciated persons and also in those with very flaccid abdominal walls the limits of the tumour can be better defined by palpation than by percussion.

The tumour may extend upwards beneath the anterior edge of the liver or lower edge of the spleen; downwards below the crest of the ilium; inwards to within a few inches of the median line, and outwards so as to bulge the lateral outline of the

Fig. 105.—Polycystic Kidney, from a woman aged 51, causing much irregularity of the surface, but leaving the pyramidal portions comparatively intact. (St. Thomas's Hospital, No. 2088.)

abdomen. In a few instances it has nearly filled the abdominal cavity; whilst in many cases the kidney is not sufficiently enlarged to be easily detected during life unless specially searched for; on the other hand it may weigh five or six or even sixteen pounds (Hare's case).

In some of the recorded cases the increase in size has taken place chiefly in the direction of the median line, and the tumour, or the bulk of it, has presented in the epigastrium. The character of the tumour varies: it may be more or less soft or yielding, but more often it is hard and feels solid to the touch. It does

not fluctuate, may be more or less rounded, but often preserves quite the kidney outline. It is more or less tender on pressure; frequently its surface is irregular and bossy, or botryoidal, owing to the projection of the cysts beneath the capsule (Fig. 105). On the other hand, it is often quite smooth and even; but whether smooth or irregular, it is, as a rule, equally non-fluctuant. In only very exceptional cases has obscure fluctuation been noticed. The kidney is very likely to be movable, and to be easily pressed towards the middle line.

The general symptoms.—Under this head must be considered the urine, the gastro-intestinal, the nerve, the pulmonary and cardiac disorders, and œdema.

1. The *urine* is in most cases normal in amount, and there is no undue frequency in micturition. Exceptions to this rule have been observed, and more frequently in respect to the amount of the urine excreted; but in one or two cases there has been great frequency in micturition throughout (Bond). Anuria (not very rarely) and polyuria have been recorded. Intermittent polyuria of moderate intensity has been noticed in many cases.

Intermittent albuminuria and hæmaturia are amongst the frequent symptoms. Hæmaturia is a fairly common but by no means constant symptom; it was found in nineteen out of seventy-eight cases. It may be recurring and profuse; it may come on with attacks of pain; and it may be quite an early symptom; or, on the other hand, only appear a very short time —a few weeks or a day or two—before death. In a typical case recorded by Whipham* a large quantity of blood appeared in the urine three days before the man's death, which occurred suddenly from urgent dyspnœa. There had never been any renal or urinary symptoms previously.

Albuminuria is more frequent than hæmaturia. It was found in thirty-three out of seventy-eight cases; but it is inconstant, in some cases being slight and intermittent, in others moderate, and in others again considerable. In this respect it is like the albuminuria of interstitial nephritis. It has in several cases been absent throughout. The urea is frequently diminished in amount. The occasional presence of hyaline or granular casts in abundance shows a degree of inflammation of the portions of parenchyma persisting between the cysts. After the disease has existed some

* *Path. Soc. Trans.*, vol. xxi., p. 244.

time pyuria may appear, the pus being derived from the pelvis of the kidney. On rare occasions one or more of the cysts which may have suppurated burst into the renal pelvis and give rise to a distinct discharge of pus with the urine, which previously may have been and subsequently may again become free from pus.

The characters of the urine are often like those of the urine formed by granular kidneys—pale in colour, of low specific gravity, abundant in quantity, and albuminous when not admixed with blood. Coagula, as well as granular casts, are occasionally present. The reaction may be either neutral or acid. The specific gravity in the same patient may vary from 1008 to 1020 at different times. In some of the cases, especially of "movable" polycystic kidney, sudden distension of the bladder has occurred with immediate relief of pain in the renal region, though without entire disappearance or marked diminution of the loin tumour. In cases where hydro-nephrosis does not co-exist the distension of the bladder and diminution in the size of the tumour are probably explained by the bursting of one large or several smaller cysts into the renal pelvis.

Œdema, anasarca, and ascites are all rare occurrences, and when present are often the mechanical effects of the pressure of the tumour. In these respects polycystic kidney seldom simulates chronic nephritis (Bright's disease). Œdema, according to Ritchie's analysis, was recorded to have existed for a time in eleven cases out of seventy-eight. In ten cases it is stated definitely that there was no œdema.

2. *Gastro-intestinal* disorders were noted in nineteen out of seventy-eight cases, but it is certain that they occur much more frequently than this. Nausea, vomiting, flatulence, loss of appetite, furred tongue, diarrhœa or constipation and consequent increasing weakness and emaciation, are common symptoms.

3. *Nerve disorders.*—Headache, giddiness, delirium, convulsions, and finally coma have each been observed repeatedly. The delirium may be continuous, loquacious, or violent. M. Jaccoud has recorded a case in which the uræmia took the form of tetanic spasms. On the other hand, in a large number of instances, the intellectual faculties remained quite undisturbed.

4. *The pulmonary and circulatory organs.*—Dyspnœa, due to asthma, pleuro-pneumonia, pleurisy, broncho-pneumonia, or generalised bronchitis, is not unfrequent. Croupous pneumonia, with

acute œdema of the lung, has been mentioned by Strübing.
Dyspnœa, or some pulmonary affection, was present in thirteen
out of seventy-eight cases. Pericarditis, hypertrophy of the
left ventricle, dilatation of the right ventricle, with hypertrophy of
the left, have been found during life, but more frequently dis-
covered after death. With cardiac hypertrophy very generalised
atheroma of the arteries has been observed, and this no doubt
has in some cases accounted for the hæmorrhages in various forms
which have occurred in certain cases of polycystic kidneys, such as
cerebral hæmorrhage, epistaxis, hæmorrhage of the bowel, hæmor-
rhage at the back of the pharynx, petechiæ, and bleeding gums. In
one case in which there was hæmorrhage from the gums there
were also hæmaturia, epistaxis and hæmorrhage from the rectum,
so that the case appeared like one of hæmorrhagic purpura or
scurvy.

The general aspect of the patient. — This varies between
the extremes of apparently robust health and the so-called
cancerous cachexia. Twenty out of seventy-eight cases are
described as anæmic, cachectic, or emaciated. When the other
symptoms have been sometimes prolonged or are very pronounced,
the patient becomes thin, his face drawn and pinched, and his
skin pallid sallow, or of a bronze tint such as is seen in Addi-
son's disease. In one or two cases the suprarenal capsules have
been diseased, but the bronze tint has been seen in cases in
which these organs have been quite healthy.

Diagnosis.—When it is remembered that in nearly 9 per
cent. of the patients there are no symptoms whatever referable
to the kidneys ; that in many instances uræmia has been followed
rapidly by coma and death in persons who have shown no pre-
vious evidence of illness ; that a tumour was discovered during
life in only 25·5 per cent., and that about 50 per cent. of the
patients complain of symptoms more or less closely resembling
those of simple chronic nephritis, we cannot be surprised to learn
from Lejars' analysis of sixty-two cases that a correct diagnosis
was made during life in only five of them.

When with a sallow complexion, hypertrophy of the heart,
and increased arterial tension, the above characters of urine and
a tumour in each of the renal regions, or a tumour in one and
an increased fulness in the other, are found, the diagnosis of
" large cystic kidney " is pretty clearly indicated.

When the symptoms of small contracted kidney, anæmia, œdema, hypertrophy of the left ventricle, increased arterial tension, diminution in the quantity of urea in the urine, polyuria, slight albuminuria, uræmia, or retinitis, co-exist with a tumour in one flank, or with increased volume of both kidneys, the diagnosis of polycystic disease is possible. In less than 5 per cent. of the cases only, is a tumour present on both sides.

It is to the characters of the tumour, when one is present, that the chief attention must be given. When there is no tumour the history, the general symptoms, the hæmaturia and lumbar pains may lead us to suspect polycystic kidney; but we cannot positively affirm its presence.

A tumour of long duration, steady increase, and bossy surface, possessing the usual topographical characters of renal tumours, should lead us directly to the diagnosis; more especially if there is a fulness in both flanks. Except for these characters of the tumour, the case might be one of renal new growth. Bilateral enlargement, whilst all in favour of polycystic kidney, is strongly against neoplasms.

Polycystic kidney is slow in growth, consistent with good health, does not fluctuate unless one of the cysts has acquired a predominant size, and is unattended by rigors or fever except in rare cases in which, probably at a late stage of the disease, one or other of the cysts suppurates. In Farr's case there was a history of attacks of rigors and fever for seven years before the kidney was removed. It had formed an enormous tumour made up of numerous sacs, the largest of which was 20 cm. in diameter, and contained about a gallon of puriform fluid of the consistence of cream. The smaller cysts contained fluid of varying characters.

The absence of any marked elevation of temperature and of pyuria, even though there be rigors and painful micturition (as in one of Newman's cases), would tend to discountenance abscess and tuberculous pyo-nephrosis.

Abscess of the renal parenchyma does not form a large tumour, though it may cause some increase in the size of the kidney, and it is commonly confined to one kidney.

The tumour in hydro-nephrosis and pyo-nephrosis may intermit and disappear entirely, and is certainly more likely to alternate in size than polycystic kidney, which usually steadily

increases. Hydro- and pyo-nephrosis may be absolutely non-fluctuant, and parts of a polycystic kidney may be elastic if not actually fluctuant. But a uniformly smooth-surfaced renal tumour which fluctuates throughout is characteristic of nephrectasis ; whilst an irregular surfaced renal tumour which is hard and solid to the touch or which is only elastic, soft or fluctuant in places, is characteristic of large polycystic kidney. It must be admitted there are exceptions in each class.

The presence of considerable quantities of pus in the urine in a polycystic case would seriously complicate the diagnosis, but would not altogether contra-indicate it.

From hydatid cyst of the kidney, as well as from simple serous cyst, polycystic kidney is to be diagnosed by the character of the tumour where there is one, by the bilaterality and by the symptoms indicative of chronic interstitial nephritis such as are shown by the urine, the cardiac hypertrophy and the arterial changes. In hydatid disease, when the liver as well as the kidney is the seat of a tumour, the swelling of the liver is rounded, uniform, and often fluctuating ; not nodular or bossy on its surface like a polycystic kidney. Hooklets or scolices will most probably be found in the fluid of hydatid cyst. In the presence of metrorrhagia polycystic kidneys have been mistaken for double ovarian cystomata, as in the case reported by Jean Ferrand.*

Prognosis.—The evolution of polycystic kidney is slow, its duration is indefinite. There may be a long latent period during which no indication is given that the patient is not in full health, and then an unexpected attack of uræmia, or pneumonia, pulmonary œdema, cerebral hæmorrhage, rupture of the left ventricle, convulsions, coma, or anuria may cause sudden or rapid death. In the last stages of the disease when the approach of death is gradual, obstinate vomiting, convulsions, suppression of urine, and coma supervene, and immediately precede the fatal-termination. Death sometimes occurs from exhaustion brought on by hæmaturia, sometimes from bronchitis or pneumonia, sometimes from œdema of the lungs, and sometimes from some quite independent cause.

If one kidney only is affected life may last for years and be terminated finally by exhaustion from pain in the loins and the abdomen, hæmaturia or other hæmorrhages, or gastro-intestinal disturbances.

* Société Anat., Mai 20, 1898.

Life has certainly been prolonged in two cases under my care by nephrectomy.

If both kidneys are affected the duration of life depends on the rate of progress of the cystic change, and will probably be terminated in from one to ten years. In twenty-eight cases collected by Ritchie, the time during which the symptoms had existed is recorded : fifteen died between the first and tenth year, the others lived periods varying widely from three weeks up to one year, and from ten years up to twenty-two years. In one of my own cases symptoms like those of renal calculus extended over fourteen years before death from double renal and hepatic polycystic formations occurred.

The causes of death were coma, convulsions, or uræmia in thirty-eight out of seventy-two cases ; pulmonary œdema or some other form of chest affection in thirteen ; cerebral hæmorrhage in eight ; exhaustion in six ; heart and aortic disease, hæmorrhage, and pyæmia after injury, are given as the causes of death in the other cases. One succumbed after an operation.

Treatment.—The surgeon's aid will not often avail, owing to the frequency of the bilateral character of the disease. When the disease is unilateral the elimination of urine is carried on sufficiently well by the sound kidney, and no treatment is requisite unless the size of the tumour is very inconvenient and the pain caused by pressure is considerable, or unless some condition such as hæmorrhage or infection from suppuration is threatening the life of the patient.

The prevalent teaching at the present time is opposed to any surgical procedure in the treatment of large polycystic kidney. The reasons given for this attitude are in the great majority of cases only too valid : they are (1) that polycystic disease affects both kidneys, and if the disease is much advanced in the other kidney nephrectomy exposes the patient to rapid death from anuria within a few hours, or at longest within two or three days ; (2) that as the cystic changes do not affect both kidneys to the same extent or in quite the same manner, nephrectomy of a large tumour-sized kidney is more than hazardous, because the other kidney may be too much affected to be able to maintain life, though it does not give any clinical sign of enlargement ; (3) after recovery from nephrectomy for a large polycystic kidney the remaining kidney may rapidly develop cystic changes, and

so after a few months, or longer, may present all the clinical and pathological characters of the one removed.

Whilst agreeing with these objections in the main, I am unable to give unqualified adhesion to them. In the first place, I would say that no surgical operation should be entertained if there is good ground for suspecting polycystic disease of both kidneys, either from the characters of the tumour, or the presence of the ordinary symptoms of chronic interstitial nephritis.

If, on the other hand, the tumour though typical in character is unilateral, if the suffering caused by it is great, or if the tumour is rapidly increasing or causing distressing gastro-intestinal symptoms, the question of nephrectomy ought to be entertained. A trans-peritoneal incision should be made, the opposite kidney palpated, and if found normal, nephrectomy of the polycystic kidney should be performed. These are cases in which the incision of Langenbuch is of great value, permitting as it does a manual examination of the kidney for a pathological condition which is readily detected by touch, and in which the changes are frequently (some writers state constantly) most marked on the anterior surface, the only aspect of the organ which can be palpated across the abdomen. Moreover, through the incision much of the tumour can be enucleated from its areolar tissue couch and can be ultimately delivered.

In cases where there is no tumour detectable—either because of the thickness of the abdominal wall, the very moderate dimensions of the kidney, or some other cause—there are often urgent symptoms, such as profound or continuing hæmaturia and severe renal pain, which will naturally lead to an exploratory lumbar incision and thus to the discovery for the first time of the polycystic state of the organ. Under these circumstances the opposite kidney should first be explored, either by the trans-peritoneal route or by an incision in the opposite loin, and if the second kidney is not affected or but very slightly so, nephrectomy of the kidney causing the pain and hæmorrhage should be performed.

These have been the principles which have guided me in five cases upon which I have operated. Two of the cases operated upon on May 3rd, 1894, and February 21st, 1898, respectively, are now alive and well. In a third case, a large rapidly growing tumour was removed by the lumbar and trans-peritoneal method, but the patient on the second day after the operation got acute

dilatation of the stomach and was suffocated whilst vomiting a large quantity of fluid. In a fourth case the kidney was large, rapidly growing, and the cause of very great pain; nephrectomy was performed in July, 1893; the patient recovered and was very well for a time, but within four months after the operation the second kidney had become like the first, and in November, 1893, I exposed the kidney through the loin and relieved the pain and tension by tapping two large cysts. The patient died several weeks later from slowly increasing uræmia.

In the fifth case a well-made, muscular, though stout man, a teacher of languages, aged fifty, had suffered from right renal pain and symptoms like those of renal calculus over a period of fourteen years. He had passed gravel on several occasions, and a small stone four years before. In March, 1898, he had an attack resembling renal colic on the left side as well as on the right, and the quantity of urine passed became very small. No tumour could be detected on careful palpation. This case, which I had on several previous occasions seen, came with these symptoms again under my notice and was diagnosed as one of double renal calculus with partial anuria from the sudden stoppage of the left—the previously unaffected—kidney. The left kidney was exposed through the loin, and found to be polycystic, but contained no stone. Several of the cysts were punctured, with such marked relief ·that two days later the right kidney was similarly treated with a similar beneficial result as regards pain; it was in a similar condition to the left. The patient died on the ninth day after the attack, after five days' complete anuria. A post-mortem examination showed the liver as well as the kidneys to be in a most advanced stage of polycystic degeneration. There was no stone or other gross obstruction present throughout the urinary organs.

Unsatisfactory as these results are, yet two out of the five patients have had their lives prolonged and in complete comfort by nephrectomy, in one case for nearly seven years, in the other for three years. In the third case of unilateral disease the patient might have recovered and survived for years, like the other two, had he not, so to speak, died an accidental death by suffocation whilst vomiting. Kelly, of Johns Hopkins Hospital, in 1890, successfully removed the suppurating cystic kidney reported by William F. Farr and referred to above.

Vitrac,* quoted by Tuffier and by Albarran, collected seventeen cases of nephrectomy for large polycystic kidney, with only five deaths, two only of the deaths being due to uræmia. From a collection of cases published between 1867 and 1886 by various authors, Brodeur tabulated fifteen cases of operation for different forms of cystic kidney, of which two were polycystic kidneys; and of these two cases one died and one recovered.

Tuffier and Albarran discountenance the operation. Tuffier, however, practised partial nephrectomy upon a woman who had a number of small cysts in the inferior third of her kidney; he removed the inferior half of the organ, and the patient remained well two years afterwards.

The argument against nephrectomy, because of the liability of the second organ to subsequently take on the same change as the first, applies equally to partial nephrectomy; one would expect the cystic degeneration to take place even more rapidly in the other half of the same organ than in the second kidney. But I do not think the argument altogether a good one: it would apply equally to nephrectomy for calculous pyo-nephrosis, if the second kidney has been, or because it may become, the seat of stone: it is the argument popularly employed against operations for cancer generally.

When the opposite kidney has been ascertained, either by inspection or palpation, to be unaffected, we are not justified, in my opinion, in refusing a patient the relief from severe pain or hæmorrhage or from the dangers of infection from suppuration of the cysts which nephrectomy affords.

In any case in which the life of the patient is threatened, as, for example, by profuse and persisting hæmorrhage, as in Depage's case, the operation would be imperative.

When a kidney is cut down upon for an exploratory purpose, or because of the mobility of the organ, and the poly-cystic condition is revealed, nephrectomy ought certainly not to be performed, until the state of the opposite organ is ascertained to be good. A movable polycystic kidney may be fixed by one of the methods of nephropexy: if hydro-nephrosis complicates the cystic state of the organ, as in a few recorded cases it has done, the hydro-nephrotic sac should be tapped or incised, and its edges stitched to the skin and drained if the obstruction in the

* *Journal de Médecine de Bordeaux*, Décembre, 1895.

renal pelvis or ureter cannot be removed. Relief may follow fixation, as Newman points out, by remedying "transitory hydronephrosis" if existent in a movable polycystic organ. Newman in one case practised the removal of a large part of the fibrofatty capsule, and advises this procedure if this tissue is redundant. Contrary to the opinions expressed above, but in accord with the majority of authors, he thinks that it is not advisable to cut into a polycystic kidney or to remove it even when there is no evidence of disease of the second organ.

When the disease is suspected to be bilateral; or when one organ is discovered to be polycystic on exposure, but is neither hydro-nephrotic, nor movable, nor suppurating, nor painful, the wound should be closed without further interference. If, however, great pain is caused by the size of the cysts, temporary relief, as I found in the case above referred to, may be given by puncturing or incising some of the larger cysts.

HYDATID CYST OF THE KIDNEY.

Before the thesis of Béraud,* published in 1861, there is little accurate information to be found bearing upon hydatids of the kidney. Prior to this date simple serous cysts, cystic degeneration of the kidney, and even hydro-nephrosis, were indiscriminately described by writers and catalogued in museums under the title of "Hydatids of the Kidney." Even Chopart, who in his work "Diseases of the Urinary Organs" (1855), devotes a chapter to the subject, makes this confusion.

After Béraud's classical monograph, there appeared Finsen's work on "Hydatid Disease in Iceland" (1869), and in this country the instructive chapters in the standard works of Roberts and Dickinson, and the articles by Davies Thomas.† On the Continent the admirable study of the subject by J. Bœckel was preceded and followed by various contributions by Neisser, Simon, Madelung, Fisk, Vogt, and others. In the Australian Colonies the subject of hydatid disease generally received great attention, especially in regard to operative treatment, after Gardner brought it before the Intercolonial Medical Congress of Melbourne in January, 1889.

Hydatid cysts sometimes form large tumours in connection

* "Hydatides du Rein," Paris.
† *Lancet*, 1879, vol. i., p. 297.

with the kidney. They are comparatively rare, occurring very seldom in comparison with the frequency with which they are met in the liver, and being somewhat less common than hydatids in the lungs; but they are more frequent than hydatids in any other organ of the body except the liver and lungs.

Davaine, among 566 echinococcus cysts, found only thirty, or 5·3 per cent. affecting the kidneys. Neisser, in a later research, found eighty cases amongst a total of 983. Finsen found only three cases of renal hydatids amongst 255 of hydatid disease observed in Iceland ; Davies Thomas says " the kidney is affected in 4·74 per cent. of all collected cases," but records only two cases in 307 hydatid cysts of all organs occurring in Australia. In his own practice, according to Gardner, Thomas only met with a single case of hydatid of the kidney. Gardner's own statistics show that less than 1 per cent. of all his own cases were situated in the kidney, and he is of opinion that the kidney is not even nearly so frequently affected as the statistics of published cases would lead one to suppose. If we add together the figures of Davaine, Neissen, Finsen, and Thomas, we have 2,111 cases of hydatid disease of all parts and organs, in 115 of which the kidney was the seat of the disease, giving a percentage of 5·44. The figures of Thomas and Finsen, taken alone, support Gardner's view that the relative frequency is much nearer 1 than 5 per cent. Mossler also, who practised in Mecklenburg where the disease is very common, only met with hydatid of the kidney in one case in twenty years.

There is no difference, judging by the aggregate of recorded cases, in the frequency with which hydatid of the kidney occurs in the two sexes, although in the experience of Gardner of Melbourne, which was very considerable, men were twice as often attacked as women. Houzel, on the other hand, states that women are more commonly affected than men ; and Bœckel seeks to explain the same by attributing the cause to pregnancy, though the causation effect is not clear. As regards age, the disease appears more frequent between eighteen and forty years,* instances, however, are cited in a child of four years (Desault and Chopart and Rayer), and in a woman of seventy-five.

Pathology.—The left kidney seems to be nearly twice as frequently affected as the right, but for this the explanations

* Béraud, " Thèse de Paris," 1861.

which have been offered are not satisfactory; neither that sug-
gested by Béraud, namely, the greater attraction of the liver
for the eggs of the tænia, which travel to the right side, than
of the spleen for those which go to the left side; nor that offered
by Houzel, namely, that the eggs which have travelled through
the lymphatics, systemic veins, pulmonary circulation, and left
side of the heart, as, according to Bœckel, they must do before
they can arrive at the kidneys, go to the left organ rather than
to the right, because of the shorter distance to the left kidney
along the left renal artery than to the right kidney along the
right renal artery from the aorta. The cysts may occupy one or
both kidneys. Richardson and Hogg have each recorded instances
of bilateral renal hydatid. A cyst, or several small cysts, may
occupy one end of the organ only, while the remainder may be
healthy—any part of the kidney may be invaded. A cyst may be
situated immediately beneath the capsule or be lodged deeply in the
substance of the kidney; in either case, as it grows, it forms
an elastic rounded and sometimes fluctuating tumour projecting
from the surface of the organ. The whole kidney may ulti-
mately be destroyed and the cyst may come to fill a large part
of the abdominal cavity; in other cases it remains quite small
and does not exceed the size of an egg or an orange. The
renal substance, as a consequence of pressure, tends to atrophy
and to degenerate; and as the result of the irritation there is not
unfrequently an increase in the amount of fibrous tissue; in other
words, the parenchyma may be either entirely destroyed by pres-
sure or greatly altered by sclerosis. Surrounding the "endocyst"
of Huxley, there is the usual tough fibrous ectocyst of variable
thickness, such as is common to hydatid tumours of all other
organs. The endocyst may undergo calcareous or cartilaginous
transformation. The inner surface may be either smooth or mam-
millated like an hypertrophied bladder, or irregular and shrivelled
upon itself, "like the surface of the ovary of an old woman."
The contents of the cysts vary : generally there are brood capsules,
scolices, daughter cysts few or abundant, small or large; some-
times there is nothing but fluid, the cysts being "sterile" or
"barren"—the so-called "acephalocysts." Of the daughter cysts,
some move freely within the parent cyst, others are adherent to
its walls. The hydatid fluid is clear, limpid, colourless, or slightly
opalescent, and of low specific gravity (1004 to 1015). It usually

contains uric acid crystals, crystals of phosphates, and ammonio-
magnesian phosphates, phosphates of soda, and oxalate of lime;
chloride of sodium, little if any albumen, and scolices or hooklets
are usually present.   Sometimes small calculi the size of peas or
horse-beans composed of these salts are formed in the cysts.
When the cysts are of large volume they are apt to contract
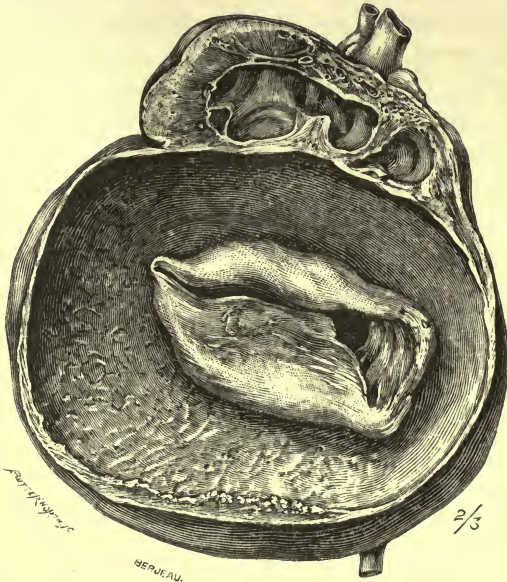adhesions with surrounding organs.   In many cases a hydatid

Fig. 106.—Hydatid Cyst of Kidney, about three inches in diameter, with partly
calcified walls.   It does not communicate with the renal cavity.   (St.
Thomas's Hospital Museum, No. 2134.)

cyst of the kidney has co-existed in the same person with hydatid
cyst of some organ tissue or organ, but especially of the liver.
An echinococcus cyst may bring about an abnormal degree of
mobility of the kidney.

A renal hydatid cyst may burst into the pelvis of the kidney,
or into the intestine or lung.   Out of sixty-eight cases collected
by Béraud forty-eight opened into the pelvis of the kidney, with
the development in some cases of pyelitis.   Ebstein states that
" cysts open into the renal pelvis most quickly when they are
developed in the medullary cones.   The tumour in these cases
does not attain a large size.   When developed in the cortex, or

between the renal capsule and the kidney, the cysts attain the largest dimensions of which they are capable." Roberts tells us that they have a natural tendency to discharge their contents by the ureter, and that out of sixty-three cases collected by him hydatids were disharged by the urethra in fifty-two cases. In forty-seven the cysts opened into the pelvis of the kidney only, in one into the pelvis of the kidney and the lung, in three into the intestine, and in one into the stomach as well as into the renal pelvis. In one case the opening was into the lung only, in two the cyst was opened artificially, and in eight cases it did not open at all. Roberts also states that there is no authenticated case of a hydatid cyst of the kidney opening upon the loin, and that Rayer's two cases which so opened were hydatids in the muscular tissue of the lumbar region. In a third case there was post-mortem proof that the cyst was unconnected with the kidney.

Hydatid cysts of the kidney as of the liver may inflame and suppurate ; or may wither, contract, and dry up into a putty-like mass consisting of phosphates, cholesterine, and fatty granules, together with echinococci hooklets and shreds of laminated membrane. Perinephritis or an abscess near the kidney may be excited by the presence of the tumour. Hydro-nephrosis has resulted from impaction of a vesicle in the ureter.

Etiology.—The formation of hydatid cysts in man is the result of the entrance into his body of the ova of the tænia echinococcus of the dog. They are met with in most countries where men and dogs are brought into intimate association, but they are especially common in parts where the poorer classes use the flesh of the domestic dog as food, or eat off the same plates as their dogs, *e.g.* Iceland, Mecklenburg, and Silesia. The disease is very common also in Australia.

In order to reach the kidney the eggs of the tænia, which are taken into the stomach and intestines with any form of ingesta except those which have been cooked, must enter the general circulation either by the venules of the portal circulation or through the lymphatics of the mesentery. By either route they must pass through the right side of the heart and the lungs before they can reach the left side of the heart and the general systemic arterial system. When travelling by the lymphatics, they must enter the thoracic duct, and thence gain the jugular vein. We thus see why the liver and the lungs are so much more com-

monly the seats of the disease than any other organ. Once through the lungs these eggs may obtain a habitat in the heart itself, in the brain, spinal cord, the muscles, spleen, kidney, or other structures.

Kirmisson attributes to injury an important causation in local-ising the disease. Contusion ruptures the small vessels, and the escape of the blood, if it contains the eggs of the tænia, into the tissues tends to the development of the hydatid at the site of the injury. This possibly may explain the occurrence of hydatid cysts in the muscles of the limbs, in the brain and spinal cord, but can hardly do so in the case of the heart, and probably only very rarely does so in the case of the kidney.

Wherever arrested, the embryo sets up a slight inflammation whereby it becomes encysted, whether it remains sterile or pro-liferates. Developing very slowly, it causes but little interference with the surrounding tissues, until it becomes troublesome by its excessive volume. Thus is explained the very slight effect these cysts produce, and the length of time they take to become harm-ful to the individual they infest.

Symptoms.—A hydatid cyst develops insidiously and pain-lessly and often without awakening any suspicion of its presence until it has attained a size when it begins to cause symptoms of compression on surrounding organs. A sense of weight or dragging, not pain, is the first or only symptom complained of, though the tumour may be discovered on palpation before even this degree of local sensation has been aroused. In some in-stances there are no symptoms, and the cyst is met with as a post-mortem surprise. In others there are no symptoms until the cyst bursts, in the common manner of the disease, into the renal pelvis, when attacks of renal colic begin and recur owing to the passage of the daughter cysts and portions of the hydatid membrane along the ureter. In a third class of cases there is an abdominal tumour, with or without the symptoms excited by the escape of the contents of the cyst along the urinary passages. There are no urinary symptoms before rupture. If the secreting capacity of the kidney involved is much impaired, the opposite organ is correspondingly hypertrophied. Even the affected kidney does not cease to properly perform its functions; and Houzel records a case of a patient on whom he operated who had but a single kidney, and that was occupied by an enormous cyst, yet the organ secreted a litre of urine a day.

In eighteen out of sixty-three cases, according to Sir W. Roberts, a tumour in the side was discernible during life, and varied in size from an orange to an adult head. Fluctuation is not always to be detected, owing either to the extreme tension of the cyst walls, or to the small proportion of fluid to daughter cysts of many succeeding generations. The hydatid thrill or fremitus has been but seldom observed. Out of thirty cases it was present only in two. It is a symptom of great value if it exists, but its absence goes for nothing. Several conditions may prevent fremitus as well as fluctuation from being felt; such as the deep situation of the cyst, the thickness of the abdominal parietes, the degree of tension of the cyst, the thickness or cretification of the cyst walls, and the close packing of daughter cysts, with a scanty quantity or no free fluid in the cyst. For hydatid fremitus to be present, certain conditions are required : the cyst must be superficially placed, not too tense, and the daughter cysts must be able to glide against one another. Sterile cysts are possibly capable of giving the fremitus ; for, as Gardner pointed out, it can be felt by taking an unruptured daughter cyst in the palm of the hand and tossing it up. It is doubtful whether true fremitus is ever felt except in echinococcus cysts. Davies Thomas states that it has been noticed in other conditions ; but it is generally regarded as pathognomonic of hydatid cyst. I have never observed it in any other class of cases.

By palpation the cyst can often be made out to be insepar-able from the kidney, which is usually at the back of the cyst.

The hydatids discharged *per urethram* are in various states, broken or entire, as fragments, or vesicles simplyc ollapsed. There may be one or two only, or scores of vesicles : some contain only water ; others enclose minute cysts ; crystals of uric acid have been found adhering to them ; crystals of triple phos-phates, uric acid, and oxalate of lime have been found within. When the parent cyst has suppurated before bursting, pus is discharged as well as hydatids. Hæmaturia sometimes occurs. In a case of which I have notes the cysts were discharged with large quantities of pus, but some of the smaller and unruptured cysts which were passed contained the ordinary clear saline and non-albuminous fluid characteristic of hydatids. In some cases hooklets, shreds of hydatid membrane, and oil particles, but no vesicles, are found in the urine.

In relation to the escape of hydatids by the urethra it must not be forgotten that hydatid cysts of the liver have sometimes discharged into the renal pelvis, and hydatids in the cellular tissue of the hilum or in the track of the ureter have broken into the ureter or bladder, and thus escaped by the urethra. Such cases are infinitely rare. Birkett * knew of one case in which hydatids were withdrawn by a catheter from the bladder, the cysts having escaped into the bladder from a hydatid tumour between it and the rectum. Other similar cases of hydatid tumours in this situation opening into the bladder are on record ; but they are to be distinguished from hydatids in the kidney by the formation of a pelvic tumour, and by the prolonged and increasing pressure effects upon the bladder and rectum.

The escape of the vesicles may or may not excite nephritic colic ; there may be one or several discharges at shorter or longer intervals of a few months or several years. Sometimes at the first escape the cyst empties itself and dries up ; in other cases there have been numerous discharges extending over many years, and occurring at uncertain and very variable intervals.

Pain in the lumbar region and along the course of the ureter of the affected organ, with a sensation of something giving way, usually precedes the discharge. Rigors, vomiting, spasmodic colicky pains, and sometimes suppression of urine and retraction of the testicle, accompany the passage of the vesicles along the ureter ; then comes a period of relief during their stay in the bladder, and this is followed by the distress caused by retention of urine and painful efforts to micturate which indicate their journey through the urethra.

An accident, such as a blow, kick, or fall, or the jolting of horseback or carriage exercise, may lead to the rupture of the tumour and to the subsequent escape of the vesicles by the urethra.

When a tumour exists it fills the loin, and to a greater or less degree the corresponding side of the abdomen ; it may be quite round and regular in outline, or present a somewhat nodulated surface. Its relations to the bowel and to the ribs and surface are the same, and are subjected to the same exceptions as renal tumours generally (see p. 531 et seq.).

In a case shown by Dr. Fotheringham † to the Glasgow

* *Med. Times and Gaz.*, vol. i., p. 161 (1855).
† *Brit. Med. Journ.* Dec. 6th 1884.

Pathological Society, the patient had a nodulated tumour which filled the right lumbar region and caused pain and tenderness; there were, too, the ordinary symptoms of Bright's disease. Within a fortnight after it had suppurated and discharged pus and cysts by the urethra, the symptoms of Bright's disease disappeared.

Suppuration may occur as the result of violence, or of puncture whether for the purpose of diagnosis or of treatment; or independently of either. If it occurs, then rigors, fever, and increased pain and tension about the tumour set in.

The *complications* of hydatid cysts of the kidney are (1) their excessive volume, (2) the consequences of rupture, (3) the dangers of suppuration. (1) The size attained by a hydatid cyst of the kidney may be such that it nearly fills the whole abdomen. In such cases, the digestive organs and the diaphragm and the respiratory and circulatory organs are interfered with, and death may be brought about by syncope or marasmus. (2) Before attaining such a size, however, it is more frequent for the cyst wall to rupture. Injury may also cause rupture of the cyst. It may open into the general peritoneal or pleural cavity, or into a hollow or tubular organ, *e.g.* the stomach, bowel, bronchus, or renal pelvis or ureter. Spontaneous or traumatic evacuation may be followed by cure, but it is very likely indeed not to be. Béraud and Bœckel quote twenty-nine cases in which the opening was into the renal pelvis : six were completely cured, six remained stationary, in seven the results were unknown, and ten died. The causes of death were : seven from marasmus, one from cancer, one from phthisis, and one from secondary perforation of the lung. Of four cases which burst into the intestine one died. Rupture into the lung or into the peritoneal cavity is very fatal. The danger of rupture is increased by the greater tendency there is for the cyst to suppurate after rupture has taken place than before, and thus the patient is exposed to death from septicæmia or exhaustion. Rupture into the peritoneal cavity gives rise to peritonitis if the cyst is suppurating; if there is no suppuration it may cause the development of multiple new cysts, or urticaria, or death. (3) Suppuration does not frequently attack a hydatid cyst so long as it is intact and is not in communication with the organs around it or with the exterior of the body. But if, from rupture or puncture, infective micro-organisms gain entrance, the cyst soon becomes

converted into a large abscess. Cure may follow the suppuration
if the contents of the cyst freely escape into the intestine or
renal pelvis, or still more probably if the cyst is thoroughly
drained after a free incision has been made through the loin.
Otherwise death is caused by septicæmia or exhaustion.

Diagnosis is made certain when, with a tumour in the
renal region, there is a discharge of hydatid vesicles by the
urethra, or of the other products of hydatid tumour, as shown by
microscopical examination of the urine. If the cyst does not
rupture into the renal pelvis, the urine presents no evidence
of the nature of the disease; and if a tumour exists without
discharging its contents by the ureter, there is nothing to point
out the precise nature of the enlargement except the general
characters of the tumour, and the use of the aspiratory trocar,
a means of diagnosis which, however, ought not to be resorted to
without preparation for proceeding at once to further surgical
measures. The renal origin of the swelling must be diagnosed
by the same means as other renal tumours. When vesicles are
voided, but no tumour exists, nephritic colic generally indicates
the locality of the hydatids.

A correct diagnosis is important because the treatment which
should be adopted depends upon it. There is no use, and there
may be danger, in delaying surgical treatment when once the
diagnosis of renal hydatid is made clear. But strikingly clear
and characteristic as the diagnosis may be in some cases,
errors have nevertheless been committed by the most distinguished
surgeons in past times; and in more recent years, from
amongst twenty-eight cases related by Bœckel and Houzel in
which renal hydatids have been submitted to operation, there
were thirteen in which errors in diagnosis were made, four in
which the operator was undecided, and eleven only in which
a correct opinion had been formed. The points of importance
in forming a diagnosis are the following : (1) The residence,
habits and callings of the individual in reference to association
with dogs. (2) The slow, silent, insidious growth of a tumour.
(3) The absence of pain, of fever, of general constitutional dis-
turbances and of any change in the composition or any variation
in the quantity of the urine. (4) The uniformly smooth, globular
outline of the tumour, with possibly distinct fluctuation and
hydatid fremitus. (5) The independence of the tumour of the

movements of ordinary respiration, although possibly it may be easily and extensively moved by palpation or deep inspiration. (6) The inseparable connection of the kidney, which may possibly be felt on one aspect of the tumour, in front, or behind, or at its lower end ; if the cyst springs from the lower end of the kidney the kidney itself will probably be out of reach under cover of the ribs. (7) The renal situation of the tumour, and possibly the discharge of hydatids *per urethram*, by the mouth or by the anus. (8) If there be a discharge of hydatids or scolices with the urine there will probably be attacks of renal colic, and there may be associated with these symptoms another and most important one, namely, the diminution or subsidence of the flank tumour.

Apart from hydatid fremitus, the escape of the cyst contents by the urethra, or the result of aspiration or exploratory incision, a *positive* diagnosis can scarcely be made. Renal hydatids have been mistaken for ovarian, mesenteric and splenic cysts, and for the following tumours of the kidney : (1) Hydro-nephrosis, (2) large simple serous cyst of the kidney, (3) polycystic disease of the kidney, and (4) cystic sarcoma of the kidney.

A suppurating echinococcus renal cyst may be wrongly diagnosed as (1) pyelitis, (2) pyo-nephrosis. (3) tuberculous or other abscess of the kidney, (4) perinephric abscess.

The points mentioned above, and the account of the diagnosis of each of these affections as given under their separate headings, render it unnecessary for me to repeat here the features of the differential diagnosis of these several affections.

Prognosis.—Although it is impossible to reckon upon a spontaneous cure, still there are cases in which the hydatids have withered up into a soft pultaceous mass, and others in which recovery has followed spontaneous rupture. The perils of suppuration and rupture, however, are so great that it is much better to prevent their occurrence by surgical treatment.

Roberts's list of sixty-three cases yields twenty in which recovery was believed to have been permanent ; nineteen which were fatal ; in the remainder (twenty-four) the results were not known. In ten of the fatal cases the cause of death was directly due to the hydatids bursting into bronchi, to pleurisy, the effects of pressure of the tumour, or of suppuration of the contents. In one case a large renal calculus was found with the hydatids in a solitary kidney, and the hydatid tumour opened into the

renal pelvis and obstructed the outflow of urine. In nine cases the causes of death were unconnected with the hydatids.

The duration of the disease is uncertain, but often very prolonged. Patients have gone on passing vesicles at intervals for twenty and even thirty years. There are no means, except by waiting, of telling whether more remain behind after some have escaped by the passages. If, when the cases are left untreated, the prognosis of hydatid tumours of the kidney is more favourable than that of similar tumours in the liver or other internal organs, it is because of the tendency to rupture into the renal pelvis, although, as seen from what has been stated above, this is far from being a safe or satisfactory accident. When the tumour is small and situated in the central parts of the kidney, however, the evacuation is comparatively easy and safe. There is no fatal case on record in which the vesicles have escaped *per urethram* from a renal hydatid cyst where the cyst had not given rise to an abdominal tumour. The discharge of pus with the vesicles is not necessarily unfavourable ; cases have recovered where the quantities of pus discharged have been very great. When the cyst breaks into the pleura or a bronchus the probability of recovery is very slight ; when into the bowel or stomach it is much more favourable. When the cyst grows continually, and does not burst in any direction, the dangers of a large tumour and of its pressure effects have to be met. The evolution of hydatid cysts is very tardy, many years often elapsing before any serious complication arises. But however slow the development of the cyst, it commonly leads, if left to take its course, to a fatal termination, either by rupture, suppuration, or pressure effects on the organs of digestion and nutrition, respiration or circulation.

Treatment.—Writing on this subject in 1884, I stated: "The only proper treatment is to cut down upon the tumour, and having tapped and emptied it of its fluid contents, to incise it and stitch the edges of the cyst to the margins of the parietal wound. The cysts should be opened from the loin if possible ; if not, then at its most prominent or projecting point. Aspiration may be tried before incision, but is less surely successful." There is nothing to add to or to alter in this description except to exclude aspiration or puncture as a method of treatment, and to counsel excision of the cyst itself in certain cases.

In 1884, electrolysis, simple puncture, puncture followed by

injection of iodine, perchloride of mercury or other drugs, puncture, followed by immediate drainage, and the employment of caustics or other means for exciting adhesions between the cyst wall and the parietes before puncturing or incising, were becoming matters simply of historical interest. To-day they have quite passed into the limbo of discarded procedures.

Nephrectomy has been resorted to in a few cases with very bad results. Houzel quotes six cases with five deaths; a mortality which is only excusable or explicable on the assumption that the kidney affected in the fatal cases was a solitary kidney, which he states was the fact in the patient he himself operated on, and in an unpublished case operated upon by Billroth.

It has been argued that such a mistake would be avoided if the cystoscope and ureteral catheter were employed, but to this Bazy replied that he had seen a case of single kidney with a ureter that passed round the bladder and opened upon the opposite side, which would have led to the inference that there was a kidney on the side where none existed.

In Houzel's case there were two independent ureters, but only one kidney, which contained a large hydatid cyst: the patient passed, however, a great quantity of urine, and a cystoscopic examination could not have led to the diagnosis of a single kidney.

If it is borne in mind that the function of whatever remains of the secreting tissue of the affected kidney is little or not at all destroyed by the presence of the hydatid cyst, and that as soon as the pressure is relieved the secreting function will be increased, there is no justification for removing the kidney in an ordinary case. If an intractable fistula should follow nephrotomy it will be time enough to consider the question of nephrectomy; but such a fistula is most unlikely to occur. The only conditions under which primary nephrectomy should be performed for hydatid disease are suppuration of the kidney or rupture of the hydatid cyst into the lung or peritoneum.

Nephrotomy, on the other hand, should be the immediate operation, and has given 100 per cent. of successes. Houzel * gives fourteen cases, with fourteen recoveries. Brodeur collected four cases of hydatid cysts of the kidney which were submitted

* "Contribution à l'Étude des Kystes Hydatiques du Rein," par M. le Dr. G. Houzel de Boulogne-sur-Mer: *Annales des Maladies des Organes Génito-urinaires,* Juin. 1899. p. 595; which see for bibliography.

to operation; in two nephrotomy was performed by Péan, and both recovered : in one a partial and in the other a complete nephrectomy by the abdomen was performed, and both of these patients died. The best route is the lumbar because by it (1) there is no risk run of any of the contents escaping into the peritoneal cavity ; (2) if the kidney is movable, as it often is when affected by hydatid, it can be fixed or anchored in its proper place ; and (3) cysts which are expanding, even from the front aspect of the kidney, can be reached, incised, emptied, fixed, and drained through the loin ; whereas those which are expanding from the posterior surface or from either pole can much more satisfactorily be treated from behind.

After exposing the cyst it should be punctured and as much of its fluid contents as possible should be drawn off. Then the cyst wall should be pulled as far as possible outwards, opened freely, and the contents removed. The cavity should next be irrigated with some hot aseptic solution and the cut edges of the cyst wall should be sutured to the cut margins of the parietal incision. A drain tube should be introduced and retained. The after treatment consists in careful daily changes of dressing, and if requisite, daily irrigation with weak alcoholic or iodine solution. By degrees, and in time varying from two or three weeks to a few months according to the size and the amount of cyst wall to be cast off, the cavity will contract and be filled up entirely with granulations.

Excision of the Entire Cyst.—In certain cases, when the cyst is situated on or near the surface of the kidney, or when it projects greatly from the surface of the kidney, even though at the same time it has encroached much towards the renal cavity, the whole cyst may be dissected away, and the raw surfaces of the kidney, if feasible, should be brought together by one or more sutures. This treatment expedites recovery, and is very practicable in such cases as are illustrated in Fig. 106 (p. 672) and Fig. 110 (Vol. II., p. 41).

<div align="center">END OF VOL. I.</div>